MICHAEL G. LaFOSSE • RICHARD L. ALEXANDER

Happy Good-Luck Bat

Advanced Origami

An Artist's Guide to Folding Techniques and Paper

Koi

Advanced Techniques for Experienced Folders

15 Original and Challenging Projects

TUTTLE

ADVANCED ORIGAMI

An Artist's Guide to Folding Techniques and Paper

Michael G. LaFosse
and
Richard L. Alexander

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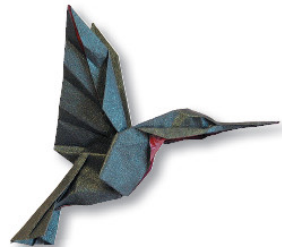

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FOREWORD

Our designing and authoring efforts at Origamido Studio have resulted in more than 75 publications to date, and if one were to ask Michael which was his favorite, he would not hesitate to say *Advanced Origami*.

The reasons are many. First, this set of projects enables Michael to tell his story through a handful of his most beloved signature creations. It is true that what was considered "advanced" when this book was first written is not as complex as what people consider "advanced" today. But rather than solely demanding technical prowess, these projects also challenge the folder to impart "the touch of the artist." Doing so successfully truly separates the advanced folder from the pack. Adding that finishing touch is one area where the newly added video clips communicate so beautifully what words and diagrams just cannot do.

Second, this book allows Michael to discuss the importance of paper—how the necessary considerations of the quality of materials and processes used in making the papers informs the folder's choices and compromises. Indeed, this was the first book (that we know of) that included custom papermaking instructions for the origami artist. As Michael was developing his creative folding talents, commercially available paper was particularly frustrating for him to fold. Even if the fibers and pigments were archival and deemed suitable for fine art, there were usually other concerns, such as the paper's size, color and texture. His artistic needs forced him to learn how to make his own paper, custom-engineered to be perfect for each subject.

Third, Michael named our studio by selecting the Japanese contraction *Origamido*, literally, "fold-paper-school." Expanding on the "do" aspect, which also connotes the path, way, journey or lifelong commitment to the folded paper arts, he revisits favorite subjects that are near and dear to his heart. Those are the subjects he often "plays," just as a musician rehearses favorite selections for a lifetime. Practice is the stuff of mastery.

Finally, and against my advice, in this book Michael has shared

his long-researched hand papermaking recipes with the public. His wisdom prevailed, and rather than destroying our business of making the perfect paper with and for today's foremost folding artists, our papers are now more popular than ever as people have realized that a recipe alone does not a tasty cake bake!

Enjoy the advanced origami of Michael LaFosse!

Richard L. Alexander, Co-founder
Origamido Studio

INTRODUCTION

ADVANCES IN ORIGAMI

The history of origami, or paperfolding, is widely recounted in books. What is not often said is that origami art is a relatively modern medium. It is, indeed, a more modern form of art than painting, music, sculpture or any other classical medium of artistic expression that comes to mind. It is so recent, in fact, that only in the last century has origami become a truly creative and expressive medium for both decorative and artistic purposes.

Initially, origami designs were passed from one generation to another. Today, advances in publishing, travel and electronic communications have aided and sped up the sharing of technical and artistic ideas in origami. With the aid of printing, photographs, video, DVD and computers, origami designs are no longer limited by the memory of the teacher and modern designs have become increasingly more complex.

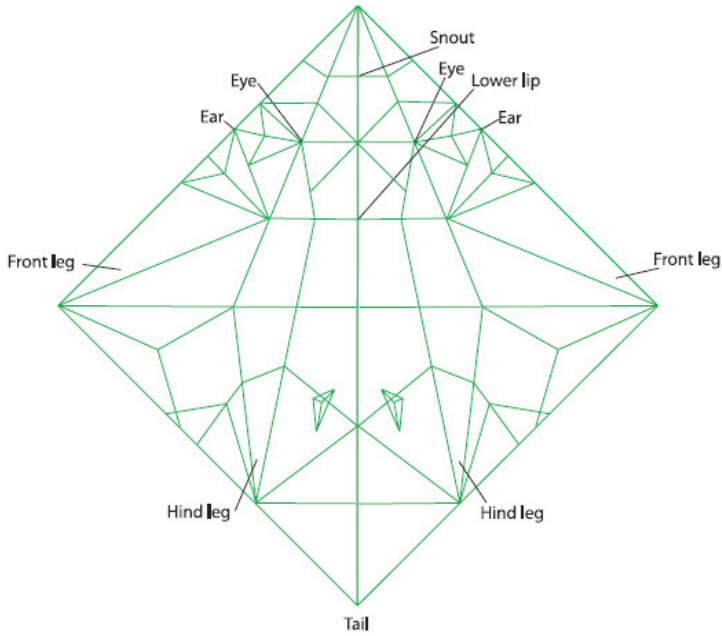
Wilbur (the Piglet) was folded "freestyle" from a single 12-inch (30.5-cm) square of handmade cotton-abaca blend paper. Michael was so taken by a live piglet

trotting across its pen while on display at the Topsfield Fair that he produced numerous gesture sketches, and even made special "pigskin paper" for this model. He also adopted an uncharacteristically loose folding style to capture the piglet's happy spirit.

These new tools have also allowed the origami community to overcome certain technical problems in paperfolding. Since many origami artists consider the use of cutting and pasting to be cheating, these techniques are not encouraged. Through the concerted efforts of the origami community, the technical problems of creating models of any complexity with folding only—no cuts—has been resolved. After half a century of development, these technical challenges have melted away. Now it seems that there is no subject that cannot be rendered without cuts.

Just as origami designs have evolved, so has origami paper. Once limited in variety of color and pattern, commercial origami paper easily met the limited needs of the hobbyist's predictable repertoire. Nowadays, hundreds of varieties of origami papers are available in a wide range of colors, patterns, textures, thicknesses and sizes. This reflects a greater demand for ready-to-use papers that are better suited to the vast new collections of origami projects published every year. This is certainly a welcome boon to the hobby. However, origami papers are still totally unsuitable for many of today's complex and super complex origami designs. There are relatively few origami artists folding at this higher level, and such advanced projects require paper with more finely defined qualities. The papers that we have been able to produce have enabled other designers to push paperfolding technology to extreme limits. The designs of Robert Lang, Satoshi Kamiya, Daniel Robinson and others have, in turn, led us to produce papers that are even thinner and stronger. This co-evolution of designs and materials is likely to continue in exciting, unforeseen ways.

We can now fold origami creations with acid-free papers, made from high-quality fiber, which can last for generations with minimal care. And with present-day hand papermaking techniques, you can make your own incredibly strong acid-free paper of any desired size and thickness, colored specifically for whatever design you can imagine.



Many advanced models are folded with methods that are not easily shown in diagrams, resulting in origami publications on video and DVD. Other advanced works are often depicted only as crease patterns with a photo of the final model, rather than individual step-by-step drawings, since most people are simply curious about the method and only accomplished folders ever attempt to fold them. The basic fold (or base) for Wilbur (the Piglet) is actually quite simple, as shown in this crease pattern. The trick with any origami model is to breathe life into the subject with a loose, lyrical handling of the final shaping that only wet-folding allows.

This convergence of technological advances in making strong, thin archival paper with the advanced computer and information tools for sophisticated origami design has resulted in truly amazing works of folded paper art. This is, indeed, the golden age of origami art, since many of the best artists of this genre are still alive today. Most have practiced their art within the last few decades, and this explosion of documented origami designs is now evident in print as well as on the Internet, where a search of the word "origami" yields thousands of offerings.

ORIGAMI AS AN ART FORM

The many advances in the technology of origami design and paper

have enabled the origami community to focus on origami as a form of art.

Origami's methodology is significantly different from most other sculptural processes. Carving (in wood, stone, ice, glass or plastic) is subtractive: material is removed to reveal the final form. Building (from sand, clay, metal, wood, plastic, glass or paper) is additive: materials are brought together to produce the final sculpture. Single-sheet origami is metamorphic: nothing is subtracted or added.

Origami is engineering, and every piece of origami represents a puzzle to those who have never seen anything like it before. Because of this, viewers ask, "How was this done?" But some origami sculptures manage to go beyond this surface reaction to convey a deeper message to the viewer. In these works, the artist's touch and vision are clearly evident. Like any work of art, these pieces are a rare treasure and the viewer will not be so concerned with how it was accomplished. This is what I strive for in my own work, and what I enjoy most in the best works of my peers.

Objects created with the intention of artistic expression are works of art. Whether they are judged good, great or otherwise depends on the audience. The choice of the medium does not determine the success of the art. Not all oil paintings are great art even though many great paintings are oils. An artist may use whatever materials and techniques are available. Just as my life was changed when I saw the origami self-portrait of Akira Yoshizawa, others are being influenced by origami art that speaks to them. Art begets artists. The more that origami art is shown, the more others explore and experience the power of that art.

This is the base that results from the crease pattern from which Wilbur (the Piglet) was folded.

ABOUT MY ORIGAMI DESIGNS

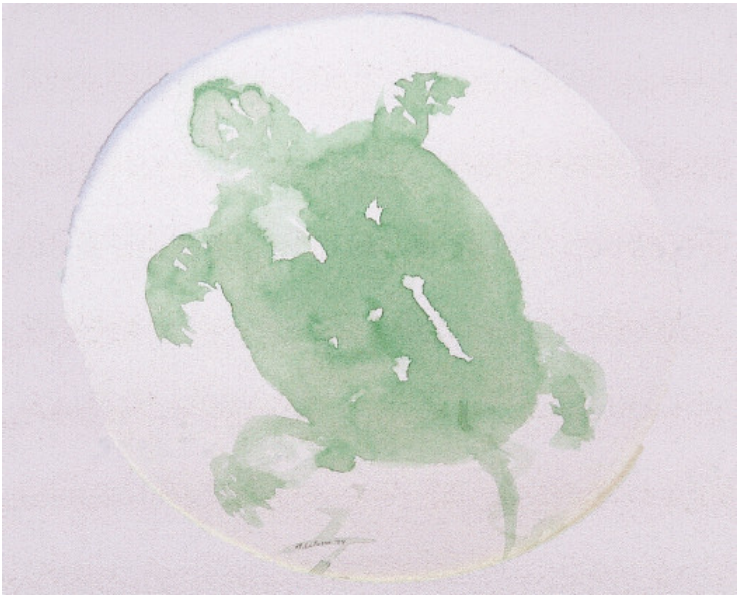
My origami designs can be attributed to a few different influences. The first of these derives from my training as a biologist, which has given me unusual opportunities to observe and study certain creatures in great detail. Initially, I am curious about the creature and try to understand it completely—its physical form, typical stances or postures, life cycle, behavior, even its individual personality. Eventually, I must admit that I shamelessly fall in love with my subjects so that I want to show others what I see by folding fairly realistic renditions of them.

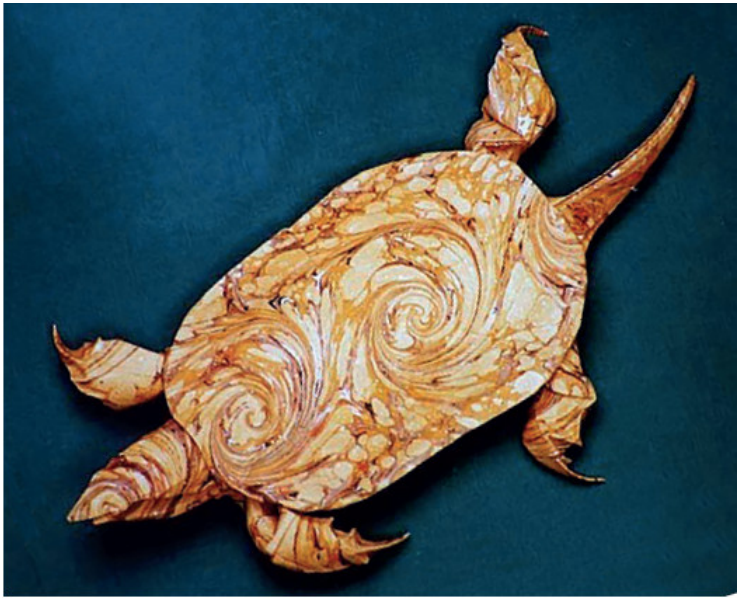
Many of my designs are based on living creatures. My most recent popular design is a simple cardinal. There are no complex techniques, nor are there curved creases. The folding is straightforward and totally landmarked (in origami, a "landmark" is a physical reference point, such as a corner, edge, crease line or crossing point of several creases, which can be used to aid in the placement of the paper during the folding process). I am fortunate to have several cardinals around my house and their personality, song and behavior have always thrilled me. I am also lucky that the side profile of the cardinal is so easily translated into a simple origami

model. It does not have to be wet-folded and you do not need special handmade paper. The typical 6- or 10-inch (15- or 25-cm) red/black duo origami paper is a perfect size range for these birds, and they make great ornaments for holiday trees and wreaths. Since, for the average folder, this is perhaps the most doable of all of my designs, the diagrams for this model appear at the beginning of the projects section. It is also one of the designs that I enjoy every time I fold it. I know each one will come out perfectly.

My designs are also influenced by my joy in the process of creating my art. I have reached a point where I enjoy continually exploring and refining a small number of designs, just as I enjoy playing the same composition again and again on the flute. From decades of experience, I can develop a folding sequence in my head, and then confirm the design by actually folding a piece of paper in my hands. I realized early that by simply folding a square piece of paper, I could make any shape, but making it elegant is the difficult part. Sometimes an origami koi emerges as a more successful model than the last one. Sometimes it might not be quite as successful in some respects. Nevertheless, it always comes out as a completely different individual.

Finally, as much as I enjoy the process of creating origami, I also like to share my art with others. To do this I co-founded the Origamido Studio with my partner Richard Alexander. This space allows us to dedicate ourselves to the art of origami. *Origamido* means "the way, through paperfolding," a word I coined to remind me that my best creations have come from goal-inspired journeys. At our Origamido Studio we hold origami workshops, design and create origami models, make our own origami paper and showcase our origami art. We also operated galleries in three different public spaces from 1996 through 2011. I take great pride in knowing that the creatures I fold will be proudly displayed in their new homes. My pieces are now found all over the world, admired and perhaps even loved as much as they were when I made them.





These two images illustrate how I conjure up the gesture for the final work using other artistic mediums for practice while studying the subject in its natural habitat.

Strombus gallus III Back View. I dreamt of finding a huge strombus on the beach. Unfortunately, Mother Nature only allows these to reach a length of about 6 inches (15 cm), so I had to make my own. I began this piece with a wax version, then made a silicone mold, which allowed me to cast a white handmade paper pulp core or armature. It took nearly two years for me to apply about 500 lay-ups (a "lay-up" is a trade term for building up a form by applying layer after layer of material) of hand-made papier mâché as I grew this shell. The gesso has plenty of calcium carbonate to stiffen the paper, since I wanted to carve through the various colored layers of paper to produce subtle stripes. The outer surface has been rubbed with paste wax.

ABOUT THIS BOOK

This book is primarily for origami artists who seek a higher quality in their work. Whether you are creating simple or complex models, paper choice, preparation, style and technique are all crucial to the final product. These decisions will set your work apart and make your experience more satisfying. The models that I have presented require using advanced folding techniques. These techniques, such as wet-folding, are essential to creating more lifelike origami models. I also have included directions for making your own origami paper, which

is so important to creating not only incredible looking models but also models that last. While there are no shortcuts, the lessons that I have learned and now present here will act as a compass for your journey.

I have chosen fifteen projects from my original designs that I believe represent the richest journeys of my origami career. These pieces led me on a path of learning, discovery and personal and spiritual growth, and have renewed my sense of wonder. Each project is folded from a single sheet of paper without cutting. Most of these subjects are the common creatures that live in local woods and fields, and you will probably find the most satisfying results while folding subjects that you, too, can study in person.

These projects may be challenging technically, artistically or both. Each project is best mastered in stages. First is the study phase, when you become familiar with the subject and learn how to fold the model. At this stage, direct observation of the living subject is valuable. Good photos or video will help. This is also when you determine if you will modify any of the prescribed folding methods. You must discover which folding steps will cause you difficulties and how you will overcome them. Practice this with ordinary materials and without wetting the paper.

Next is the rehearsal stage. Strive to master all the technicalities and try to memorize the folding sequence. To do your best work, you must become totally comfortable with the entire folding method, even if you rely upon the diagrams, sight reading as you fold. If not, you may be overwhelmed by technicalities, distracting your full attention from the performance. During this stage of preparation, you should practice with the paper that you will use for the final sculpture. Each kind of paper has its own advantages, which you will learn about only if you routinely work with it. You may have to experiment with various kinds of paper to determine the most suitable.

Strombus gallus III Front View. This view captures my lifelong love affair with the interesting and sensuous forms of mollusks. The possibilities of paper are indeed endless.

Finally comes the performance stage, where your repeated rehearsals pay off. Here you will create your finest examples as your powers have grown to produce masterful and inspiring examples. How long will this take, days, months or years? Each person is different and each project has its unique demands. The real value lies in the journey, and the quality of your experience will be evident. Be patient and your efforts will be rewarded with success.

TECHNIQUES

Why does my model look different from yours? My students have asked me this question many times. Part of the answer is experience and the other part is vision. The added skill obtained from experience is summed up in one word: *technique*.

Being an origami artist requires that you perfect many different skills, from folding to designing. As you gain more experience and develop your skills, your origami models will improve. As with any art, it is essential to learn the basics first. Without good folding skills, an artist cannot control the communication of his or her ideas. The clever technical skills that I developed prove useful when I create new origami art designs. When you look at a piece of origami art, ask yourself, "Is the designer's message clear? Does the folder understand this creature or subject? How does the choice of paper complement the work? How has the execution of the folds, the choice of the model, the color and texture of the paper, its size and its overall appearance affected me?" You will soon see that it takes both technique and vision to make art. Once you develop your folding technique, you will be able to explore the art of origami.

A REVIEW OF THE BASICS

Before I discuss the advanced techniques used to create the projects in this book, it is important that you are well acquainted with basic folding techniques. Here is a quick review.

Folding Paper Neatly

The first and most important technique in origami is to move the paper correctly. So many people begin by folding a paper crane, only to be discouraged by sloppy points, a bent beak or white showing in the middle of the wings. Much of this can be resolved by taking care to place the paper properly before creasing the fold. Good eyesight helps, and forming the fold, then burnishing the creases with a bone

folder tool or the back of a thumbnail, often makes all the difference. Generally, fold the paper away from you and crease the fold from the center to one side, then from the center to the other side. It is also important to place the crease exactly where it goes before burnishing it into place. Make sure you have good lighting and that you bend your head over the model to look straight down on the edges of the layers. Parallax will throw you off!

The process of folding a piece of paper begins with making a bend. As you decrease the radius of the curve of the bend, your commitment to the placement of the crease intensifies. You must check the position of the edges, making adjustments as you continue to flatten the bend. Some folds require that you focus on the placement of the crease, not the placement of the edges of the paper. For example, when folding steps 14 to 16 of the Cardinal, you should carefully decrease the radius of the bend while closely adjusting the roll of the flap until the crease intersects the exact corner of the paper.

Folding on a Table or Hard Surface

The best way to form a sharp crease is to burnish the fold with the back of your thumbnail against a hard surface, such as a table, board or hardcover book. Folding paper on a tablecloth will not work well. The use of a supporting surface is most useful where a clean, precise geometric look is desired. This is essential for paper airplanes and origami puzzles. A folding tool, such as a bone folder or the back of a spoon, is helpful where tough, heavy papers must be creased firmly, and to save wear and tear on your nails when folding numerous origami models.

Holding and Folding Paper in the Air

We often teach origami in schools and large assemblies, and so it is important for us to hold our paper up in the air so all can see each folding step. Invariably, we see students hold their paper in the air, too, so we tell them to use the table, and explain that we are holding the paper in the air to make it easier to see. Folding in the air is challenging to the beginner and we discourage it at these public events. When students are sure of their skills, however, they will find that folding off the table is essential to most intermediate techniques, such as inside and outside reverse folding and sinking, and advanced techniques, such as wet-folding. There is a dance-like choreography that is possible only when the paper is supported just by your hands.

Reading Origami Diagrams

Origami diagrams are easy to follow *if* you know the language. Mountain folds are indicated with dots between the dashes. Valley fold lines have only dashes. More complex maneuvers are often shown by several mountain and valley folds. The best clue is to look to the next drawing to see the resulting shape.

Basic Folds

Here is a quick review of the basic folds with which you should be familiar.

Edge to Crease

Most folds are created by lining up edges or placing an edge on a crease, then decreasing the bend until the two planes are flat. The beginner will often use visual signals to decide when the edge lines up. More advanced folders will align edges by feeling for the alignment. As you look carefully before placing the crease, be sure to bend your head over the alignment so that you can look straight across the two edges of the paper, perpendicular to the table. A folder who does this realizes that every sheet of paper has a thickness. Understanding and accounting for that third dimension is helpful when planning to eliminate gaps after reversing certain creases. Wet-folders using thicker papers tend to learn this quickly.

Inside Reverse Fold

When you pull a point between the outer layers of paper, you often turn a portion of a mountain fold into a valley fold. This maneuver is called the inside reverse fold.

Outside Reverse Fold

When you pull paper back over itself to enclose the other two layers of paper, you also turn the tip of the paper over, showing the other side. This maneuver is called the outside reverse fold.

Rabbit Ear

When you pull in paper from two directions and are left with excess that sticks up in the middle, the maneuver is called a rabbit ear.

Squash Fold

When you raise a multilayered flap perpendicular to the table and the remaining paper, open the layers, then press the center mountain fold flat to the table, this is called a squash fold.

Petal Fold

When you pull a point across the other layers of paper, lengthening the form by bringing in paper from the sides to cover the top, you are making a petal fold.

Sink

When you reverse the mountains and valleys that form a point or peak in order to create an indented form, this maneuver is called a sink.

Crimp

When you grasp a folded piece of paper and insert a symmetrical, mirror-image pair of mountain and valley folds on either side of the central mountain fold, the central mountain fold turns direction due to a maneuver called a crimp.

ADVANCED FOLDS

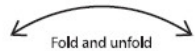
The advanced folding techniques used for the projects in this book include curved folds and wet-folding. These techniques take time to master, but they are crucial to creating complex models.

Curved Folds

Folds do not have to follow straight lines. Sure, straight folds are easy. Since two points define a line, two landmarks on an origami model often describe a great place to make a fold. Why make a curved fold? There are two reasons: one part is technological, the other is aesthetic. A curved fold locks its own shape. A straight fold is nothing more than the spine of a book, where pages are free to open and close about the spine line. A curved fold is a tension-compression structure, one with give and take. It demands that the paper respond elsewhere. A curve yields a softer appearance and throws a softer shadow. For these reasons, wet-folders often finish their models with a series of curved folds, a process that can take much longer than all of the straight folds leading up to the finishing steps.

Fold in front

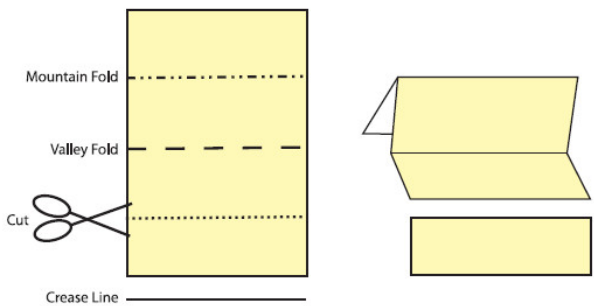
Fold behind

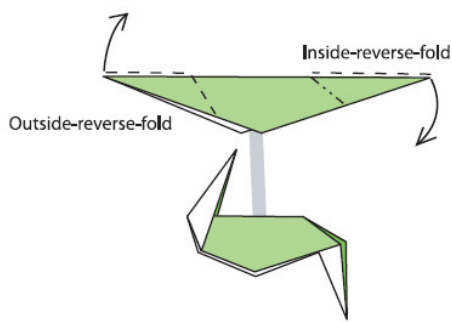

Fold and unfold

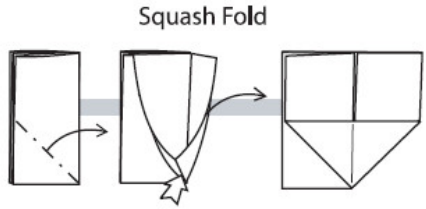
Turn paper over

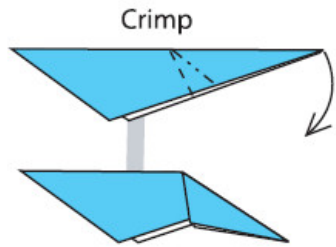
Repeat behind

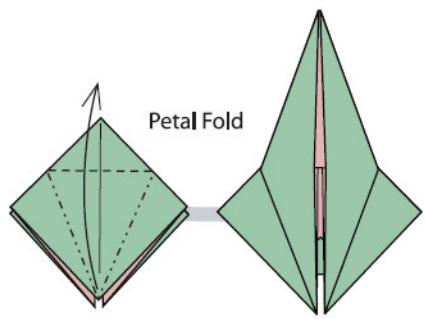
Push or pull

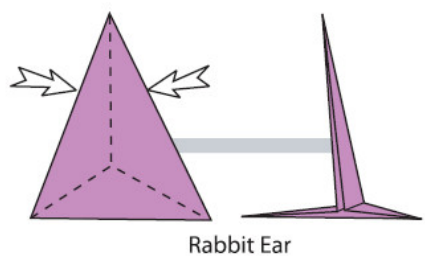

Mountain Fold
Valley Fold
Cut
Crease Line


Inside-reverse-fold
Outside-reverse-fold









To make curved folds, trace an arch with your thumb and index finger in the paper. Use these fingers in concert to "draw" the shape of the curve you need. Curves may be gentle or sharp; they may be

sinusoidal. Curved creases can add dimensionality and a lyrical, animated quality to the sculpture.

Wet-Folding

Wet-folding allows the paper to keep its integrity since the fibers will bend and not break as they do in dry folding. Moreover, the models stay folded after they dry. Heavy papers that could otherwise not be used can be wet-folded because they become flexible and compressible once they are wet.

Wet-folding changes everything. The paper fibers swell, often in one direction more than the other (see the Grain section on page 19). This throws off the point-matchers—dry folders who align every crease by matching points. The wet-folder locates the crease, not the points; there *is* a difference. The advent of wet-folding brought about a new style of origami art. Wet-folded origami fish now appear to be swimming thanks to the graceful curves possible in the fins and other folds. Wet-folded origami flowers seem to be growing, and butterflies no longer look like pin-mounted specimens in a museum box.

Ever since I began folding my own handmade papers and other soft Asian papers, I realized that I needed to back-coat or add size to them to make them stiffer. I had learned about cooking starch paste for other art projects, but since my family was in the construction business I had methylcellulose wallpaper paste readily available. It did not require cooking and when it dried it was invisible. I tried it. Methylcellulose proved ideal for my origami art. When I folded my orchid for the first time, in 1973, I was experimenting with machine-made crepe paper. I realized that I needed to add both water to fold it and size to keep it in shape after it dried. Instead of moistening and surfacesizing the entire piece of crepe paper (which would have destroyed the creping), I dry-folded the model but applied methylcellulose strategically to stiffen the lip and petals and to hold other layers together as I folded it. Since then, I have referred to this method as “folding with live paste” and I use it for folding insects and other complex designs that use very thin papers requiring additional stiffness.

Soft, rounded, gentle curves and expressive sculptural folds characterize many of today’s excellent wet-folded models. Wet-folding requires paper with supple, long, strong fibers. Wet-folding enables

the fibers to be bent, not broken, upon folding. This allows the artist to tackle complex designs that often require multiple folds along the same line or intersecting at the same point. Dry-folding these complex models would not be possible without breaking through the paper at key intersections. After being wet-folded, the subsequently dried model will retain its shape, a property particularly cherished by the serious origami art collector. Wet-folding will allow you to make use of a greater range of art papers that would be too thick to fold dry.

Typical papers chosen for wet-folding are often heavier and rather soft. You should rarely burnish wet paper with the back of your thumbnail since wet paper is prone to bruising. When wet-folding large paper in the air, you must use gravity to its best advantage, folding downward from the top, letting the hanging portions of the paper guide your fingers to their target.

Wetting the paper with water can be done in several ways, but the water must always be added to both sides of the sheet to mitigate curling of the paper. Water may be sprayed with a plant mister. You can also apply the water with a damp cloth or sponge.

Be sure to apply water evenly across the sheet and allow the water to be completely absorbed into the paper. Use the least amount of water possible. The paper should be limp and cool to the touch but it should not look wet! Add more water as needed while folding. A small, soft paint brush or the corner of a rag is useful for this purpose.

Every project in this book can be wet-folded but some, such as the North American Cardinal (page 28) and the Origamido Butterfly (page 33), will require relatively little moisture, and often that need be applied only along the line of an important crease.

Preparing Your Paper for Wet-Folding

The surface properties you want for your paper will be dictated by the characteristics of the model. A leathery creature, such as a bat, requires a stiffer fiber and plenty of sizing. A fuzzy subject, such as a piglet, requires softer fiber, such as cotton, with its fuzzier texture and warmth. Folding can be tough on the surface of the paper and most wet-folders prefer to use a size/lubricant/ paste. When it is wet, it is slippery and protective. When it dries, it seems to vanish completely. The most popular mediums used are wheat paste or methylcellulose.

Starch Paste

Archival starch paste can be made from corn starch, potato starch or wheat starch. Begin by boiling water in the lower chamber of a double boiler. Add cold water to the upper chamber, measuring five times as much water as starch (volume to volume). Add all the starch to the water and use a whisk to mix the milky suspension. Continue heating and mixing the suspension for about 20 minutes. As the starch cooks, it thickens like pudding and begins to clear. When it cools, it thickens further.

Some artisans develop a ritualistic approach to preparing wheat starch. It is a food source for some creatures, so if you are not careful with the purity of the water, the percentage of starch, the temperature or other factors, microbial growth can turn starch into sugar.Allow it to ferment and the mixture can become even further contaminated. Acidic impurities are almost always harmful to the qualities of the paper. For these reasons, we prefer to use food-grade methylcellulose.

Methylcellulose is a readily available shortcut to the traditional wheat paste used by Yoshizawa and other paper artists. It is refined and pure, so the extensive aging and purification steps are unnecessary. Most paint and wallpaper shops carry dried methylcellulose. Hand papermaking, book-binding and library arts supply companies also carry methylcellulose powder.

Methylcellulose: Preparing 10 Percent Methylcellulose in Solution (by volume)

We often prepare a batch of methylcellulose by gently adding 2 ounces of methylcellulose powder (using a liquid measuring spoon), to 20 ounces of water (using a liquid measure). Sprinkle the powder slowly onto the surface of the water as you mix the water and the methylcellulose with a stirring spatula, using a brisk mixing action. Be sure to scrape down the edges to keep the expanding polymer wet. The process is faster if you use a blender although it does tend to entrap more air bubbles.

Using either method, allow the solution to sit for at least a day or two to let the lumps of polymer dissolve. Artist-quality methylcellulose seems to be a bit easier to work with than the kind sold in wallpaper stores. This mixture of viscous material has a slippery feel, just a bit lighter than honey. (Be careful not to spill this on the floor since it is extremely slippery.)

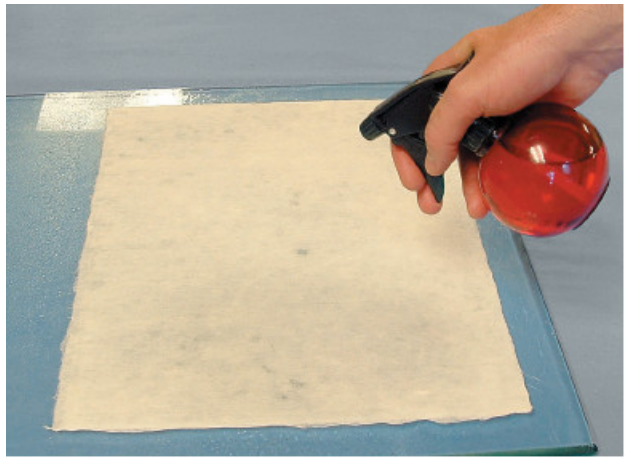
Internal size is key for some origami models. We are not too fussy about internal size any more since it is easy to add size just before

wet-folding begins. It is more versatile to leave the size out until you are sure of what you need.

Applying Size to Paper

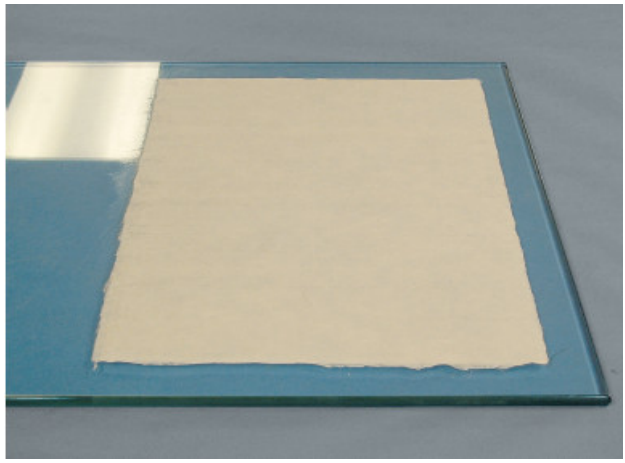
Wet-folding is often easier when the sheet is conditioned with a lubricant/size, such as methylcellulose. Before you wet the paper, cut it perfectly square. Adding moisture swells the fibers. After the model dries, the paper will return to its original dimensions.

1. Materials needed for adding surface size to paper: spray mister, methylcellulose powder, wide brush, bowl, paper.

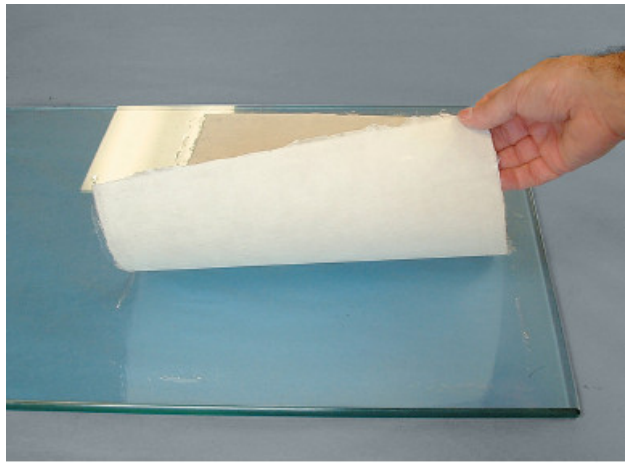


2. Moisten the paper with water, front and back, using the finest spray setting on a spray mister. Gently spread the droplets with a light sweep of a wide, fine-bristled brush (sometimes we use a sponge or a damp cloth). Be sure not to abrade the paper when it is wet. Allow enough time for the moisture to migrate throughout the paper.

3. Brush the 10 percent methylcellulose gel onto the paper. Spread evenly from the center to the edges. The methylcellulose will penetrate the paper and adhere to the glass or plastic below.



4. Allow the preparation to dry completely. One coat is usually sufficient but allow each coat to dry if additional coats are desired.



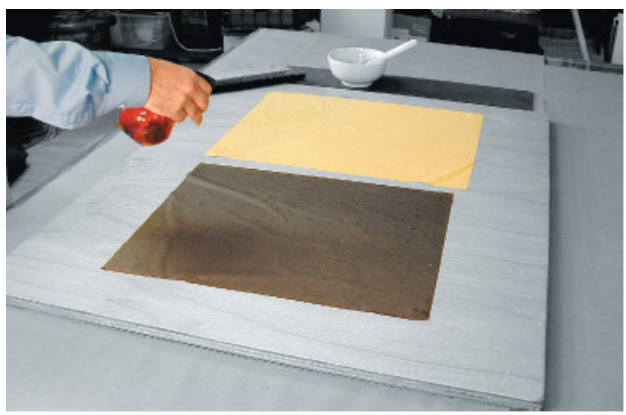
5. Peel off the sized paper. The paper will be ready to fold when it feels like leather.

Back-Coating Two Sheets Together

When you find a nice piece of paper that is too lightweight or soft for wet-folding, back it with stiffer or stronger paper. We use methylcellulose or wheat paste to bond the two sheets back to back. Follow these steps to back-coat two sheets of paper together. This is

also how we make two-color (duo) models.

1. To back-coat two sheets together, you will need the tools shown here: starch or methylcellulose powder; bowl and wet brush for the prepared paste; spray mister; wide, dry brush for smoothing; a knife (not shown). You can use a large plywood board, foam core or stiff plastic to support the back-coated sheet as it dries.

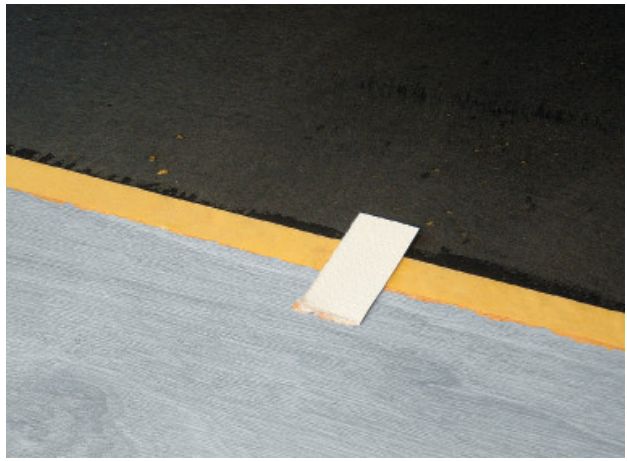


2. To begin, cut the backing paper about an inch larger than the delicate paper. Moisten each side of each sheet with a fine mist of water. Make sure they have expanded fully. Decide which side of the papers you want to show.

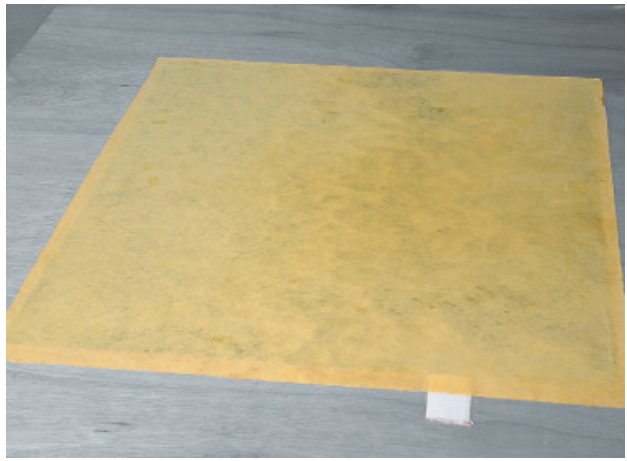
3. Smooth the water droplets with a wide, soft brush, working from the center to the edges. Coat the backing paper evenly with methylcellulose or paste in the same way, brushing from the center to the edges.

4. Using a wide, soft, dry brush, apply the second sheet onto the glue layer. Note the use of a wooden slat to control the upper free edge of the back paper as it is being lowered. Use a second wide, soft, dry brush to brush away any air pockets, working from the center to the edge. Be sure not to get paste on the brush!

5. After the air bubbles are brushed out, use the first paste brush to carefully apply another layer of paste to the exposed margin of the backing paper (this is showing beyond the edges of the nice paper).



6. Lay a small strip of paper across the glued margin to form a “gate” or “mouth.” This mouth provides a knife-insertion point that will speed up the removal of the dried sheet from the drying board.



7. Turn the wet composite over onto the surface of a board for drying. Use a clean, dry, wide brush (or the dry brush you previously used) to smooth out any air pockets and ensure good contact at the margins of the wet assembly.

8. After the composite is dry, carefully insert a sharp knife between the drying board and the paper at the mouth. Slide the knife around the margin to release it from the drying board.

9. The dried “duo” paper is now ready for trimming and wet-folding.

ABOUT PAPER

Creating origami art takes more than just perfecting folding techniques. As I mentioned in the previous chapter, it also takes vision. An important part of achieving your vision is selecting the right paper for your model. Selecting the ideal paper complements your origami project. There is a great sense of satisfaction and triumph when you find the perfect paper. Although there are many hand papermakers around, most of them have other purposes and other types of customers in mind. Maybe your needs and goals will coincide with theirs, but with the complex model you have in mind the chances of that happening are slim. This is why we make our own origami papers and why we encourage you to do the same. Starting on page 106 of this book, you will find a section on how to make your own paper. Although much time and effort are involved, the results can be stunning. But whether you create your own paper or not, it is still important to be aware of paper composition and available commercial papers.

PAPER QUALITIES

We deal with paper every day, but few paperfolding enthusiasts understand enough about the composition and manufacturing process of paper to know which paper is best for a particular project. Most folders use whatever paper is readily available, such as office paper, wrapping paper or those thin, brightly colored sheets of square-cut "origami paper." Many believe that you must use origami paper if you are doing origami. When you are making origami art, focus on the art. Use real artists' materials. So-called origami paper is an inexpensive craft-supply item designed to satisfy the casual hobbyist, crafter and grade-schooler. It is not formulated to be a lasting material for high-end, museum-quality paper art. Similarly, rarely will a hobbyist or origami crafter choose paper larger than a 10-inch (25-cm) square. Paper is by far the most limiting of the many limitations to good origami, yet the folders nearly always blame

themselves! As a former chef, I like to use a cooking analogy: "You can't make an exquisite angel food cake if you only have egg yolks and wholegrain flour. Get the right ingredients!" Become familiar with paper types and qualities. Try to understand what makes a good piece of paper, or what makes a certain kind of paper right for your project. Here are some things to keep in mind when selecting paper for your origami.

Grain

The majority of fibers in a paper with "grain" lie in the same direction. Hold a small piece of the paper horizontally by one edge, then hold it by an adjacent edge. You will see that it droops more when held in one orientation because the fibers are generally aligned parallel to the greatest bend. (Think of the way that grass beach mats roll easily with the "grain.") Grain is critically important to wet-folding. As cellulose fibers swell, they grow wider, not longer, just as a cactus, when watered, expands wider, not taller. Imagine what this does to a perfectly cut square piece of paper with pronounced grain when you wet it before folding.

Paper Strength

Paper strength is one of the most crucial elements in complex origami art. The strength of paper is related to fiber choice, length, suppleness and the characteristics achieved in the beating process. The ideal paper will have a high resistance to bursting and tearing. Paper strength can be rated when the paper is wet, and again when the paper is dry.

The extreme technical demands of today's super complex origami designs have also pushed the strength limits of readily available papers. Now our papers must be formulated to take numerous intricate creases. These additional stresses come not only from folding multiple layers multiple times, but modern origami artists are constantly turning portions of their models inside out to sink areas, or for clever color-change effects. Add to this the way that several of today's most popular origami models are "action models" with movement that often stresses the paper at key creases. In addition, now that the powerful and important technique of wet-folding has gained worldwide popularity, paper must be even stronger.

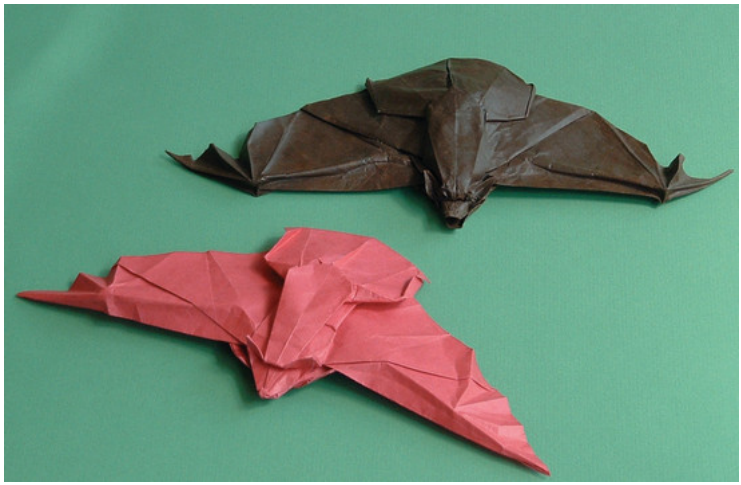
Fiber Choice and Blends

The source of the fiber and its processing dictates the qualities of the paper. Today, many communities recycle paper, and much of this fiber is processed so much that it becomes extremely short and weak. Without special chemical binding agents, much of the recycled fiber would be useless. The origami artist has a wide variety of fiber sources to consider, and each one has its strengths and weaknesses.

The most common paper fiber used in our archival papers is abaca. This fiber is from a plant in the banana family (*Musa textilis*) and is prized for its long, strong, relatively hard fibers. It may be the strongest known plant fiber! Cotton is at the other end of the spectrum, yielding a soft, fuzzy fiber that wicks moisture easily, making it one of the most desirable fibers to use in clothing, especially in humid, tropical climates. Other common plants used for hand paper-making include flax (linen), *kozo* (mulberry) and hemp. These fibers can be beaten to varying degrees, and blended in countless ways to produce a mind-boggling spectrum of handmade papers suitable for wet-folding. (See page 122 for more on paper fibers.)

CHOOSING THE RIGHT PAPER

Realize that mastering any origami model requires a serious commitment on your part, and that you may have to fold the model many times. The paper you choose for a sketch, or rough draft, need not be expensive. We often work out designs on large rolls of inexpensive thin tracing or drafting thumbnail stock, called butter paper. A rough draft of your model may require foil or tissue-backed foil (see page 23), which is a common tool for most complex origami designers. We also go through a huge amount of "practice paper"—paper that approximates the characteristics of the desired finished piece, but this paper may be "seconds" or machine-made paper readily available in art supply stores. You can purchase wide rolls of "Fadeless" brand paper, which is colored on one side and white on the other. It is ideal for practice—a "dress rehearsal" that will allow you to explore your model in a larger scale than the sculpture you eventually desire.



Here is an example of a preliminary attempt, or practice piece, of my Big Brown Bat in red commercial paper before I folded it in higher-quality hand-made brown paper.

When learning a complex origami model, the search for just the correct paper for the final piece may take some time. Narrow your search for the correct choice by starting a collection of labeled scraps or samples, noting on each your likes and dislikes, successes or failures. All this searching and practice leads up to the big moment when you finally possess the skills, the vision and the perfect paper to execute your flawless rendition of that rascal skunk in your backyard!

Also keep in mind that after investing years of effort designing and executing a modern origami masterpiece, you want it to last, so the paper must be acid-free, or "archival." Can you afford to take the chance of producing a piece of fine art using papers of unknown fiber content with questionable coloring agents or of dubious quality? And so we seek archival qualities in the paper, not only so that the colors will not fade but so that the sculpture will not disintegrate into dust from an acid attack. Perhaps there were great origami works in ages past that for one reason or another did not survive to the present. When you take proper care in making your own paper, you can be sure that your art will last for generations. That is the best reason for making your own paper.

If you are not inclined to make your own paper for your origami art, you will need to look beyond the traditional packs sold as origami paper and seek other suppliers and sources. Different papers are

made for different purposes. A tremendous selection of papers are available today, some of which are suitable for origami art, but the jargon can sometimes be confusing. Here is a simple guide to easy-to-find paper:

Bond paper has become a catch-all category for office and letter paper, sometimes containing some amount of cotton rag. "Bond" paper was formerly used to print stocks, bonds and legal documents, but we now call nearly all office paper "bond." When an idea comes to mind, most people grab the closest paper to hand, which is usually office bond. This paper is ideal for folding paper airplanes. It is rigid and smooth and it takes a crease well. Bond is a good all-purpose paper for designing and practicing most simple to intermediate origami designs. High quality bond is perfect for origami envelopes and fancily folded letters. Large sheets of bond may be cut from rolls, available at drafting supply and some art stores. It is not suitable for complex miniatures. Only the best acid-free, 100 percent rag varieties are suitable for permanent pieces. But colors are limited.

Kraft paper is brown stock with longer fibers. It is usually unbleached. It is named for the Kraft paper-making process that revolutionized commodity paper-making for cardboard boxes, bags, industrial containers and strong, economical wrappings. Kraft papers are inexpensive and are commonly sold on rolls, so large complex works are most easily explored using Kraft paper. At Origamido, we have rolls of Kraft paper in nearly a dozen colors and often fold party hats from it. The relative thickness is low since the papers are often at least 36 inches (91.5 cm) wide. On the downside, these colors fade quickly and Kraft paper looks old after a short time in strong light. It is not suitable for complex miniatures or permanent pieces. (The acid-sulfite process, the other major commodity papermaking process, is chemically harsher but it produces a brighter pulp, easier to bleach and beat.)

Kami means "paper" of any kind in Japanese. As an origami term, it is modern. Popular in English-speaking countries, it is used to indicate the most common types of origami paper used for origami experimentation and craft purposes. Standard packs have from twenty to forty colors, packaged in sizes ranging from 1 to 14 inches (4 to 35.5 cm).

Washi paper refers to any of thousands of kinds of handmade Japanese paper. It may be printed or plain, thick or thin, crisp or soft.

Since these hand-made papers are often made in small batches, or lots, with ingredients that vary with each growing season, the changes in conditions, techniques and personnel compound to yield different qualities and characteristics. Consequently, specific types of handmade papers often are unobtainable, out of stock, discontinued or off-quality. If you can afford it, purchase and store a good supply of your favorite and trusted kinds. Avoid those kinds made with wood pulp adulterants or colored with poor-quality dyes. Beware of machine-made imitations—even from Japan.

Unryu and Chirigami papers are decorative, usually made from *kozo* (mulberry) fiber, with bits of bark or strands of underbeaten fibers. These papers make great backgrounds for mounted or framed paper art, but the inclusions often frustrate the folder since the unprocessed bits do not fold well (imagine a roadblock in the path of your crease). The chunks of bark or fibers never seem to stay out of your way when you need to fold the paper, despite your best planning. Sometimes the bits even pop out of the edges of your mountain creases!

Gampi papers are glossy, somewhat translucent, and made from strong fibers from plants in the *Daphne* genus. These papers are available in many sizes and thicknesses. They are splendid for folding origami plants and flowers. Buy natural sheets and color them yourself. You will need to back-coat or surface-size these papers for most origami projects, wet or dry.

Rice paper is often used to refer to any Oriental, often white, thin paper. It is not made from rice! There are many theories as to the origin of the word rice paper but I do not know the truth about it yet. When you encounter the term in your search, ask questions about the origin and the fiber content. If you do not get an informed answer and you do not know what you have there, avoid buying the paper for serious work.

Yuzen is a general name for silkscreen-printed decorative papers. Wedding favors, party decorations and color-coordinated gift boxes folded from Yuzen are quite popular. We rarely use printed paper for animal or plant subjects unless the pattern is integral to the message. If the pattern would detract from the form and substance of the model, do not use it. Like most Asian papers, Yuzen is soft and cloth-like. Back-coat or surface-size, if necessary.

Chiyogami is decorated Japanese paper. These peaceful depictions

of rural life and pastoral settings grace Asian-themed parties. Rarely would we use them for origami art although they make elegant wrapping decorations, envelopes and backgrounds.

Paper money is widely used for origami projects. There are many hundreds of designs. The US dollar is the most popular for these purposes, but other kinds, each with their own specific dimensions, have their following. Thick but strong, these papers are suitable for simple to intermediate folding. Do not hesitate to employ wet-folding techniques! Use new bills, where possible. Pattern, shape and color all figure into the final product.

If you enjoy paper, you will enjoy the adventure of discovering rare fibers and exotic blends. Learn as much as you can about each of the papers you like to work with. Purchase extra sheets when learning about a new paper. Keep samples and record your results. Be ever alert to new kinds and do not hesitate to experiment! The cost of even an expensive sheet is cheap compared to other materials employed in many other arts. Keep in mind that learning about the vast world of paper requires a serious, deliberate effort. Do not be discouraged. In short, buy and try, but be willing to learn from failure by keeping good notes.

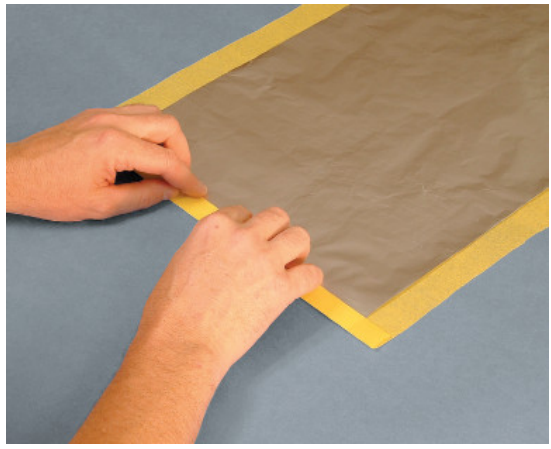
CUSTOMIZING COMMERCIAL PAPERS

If you do not want to make your own origami paper from scratch, and if you are unable to find papers that satisfy your needs, there are ways of customizing paper for use in folding. We have already discussed back-coating two sheets together and adding size to a sheet of paper (pages 14–18) as ways to prepare paper for wet-folding. Many fancy high-quality papers will be unsuitable unless you laminate two or more sheets with this method. Here are some other ways you can create customized paper:

Back-Coating Tissue to Foil

For some models, the tissue/foil paper combination creates the best results.

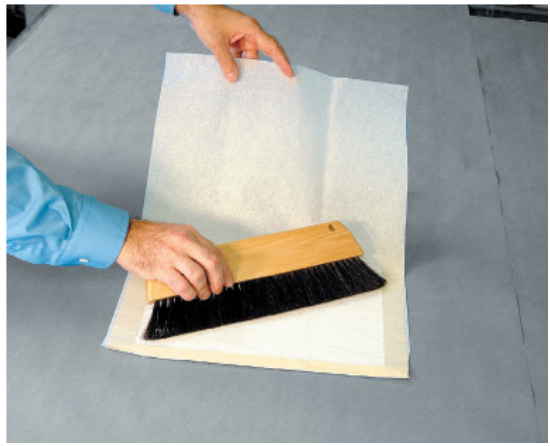
1. To bond tissue paper to foil, you will need these tools: wooden slat or dowel, commercial or handmade tissue paper, spray adhesive, aluminum foil, wide, dry brush for smoothing.



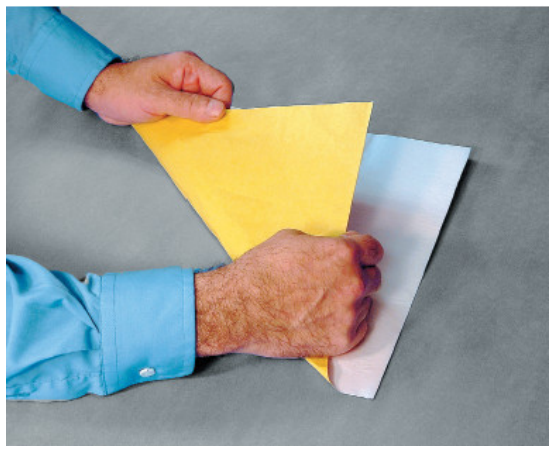
2. Fold the tissue paper over the edge of the foil twice to lock and register them firmly together.

3. Apply a thin coat of spray adhesive to the paper.Be sure that you have adequate ventilation and follow the caution label. (You may also use a glue stick, but take care not to rip the paper.)

4. Use a wide brush to smooth the foil evenly onto the glued paper surface. Use a wooden slat or dowel to control the free edge of the foil.



5. Apply a second sheet of tissue paper to the other side of the foil in the same way.

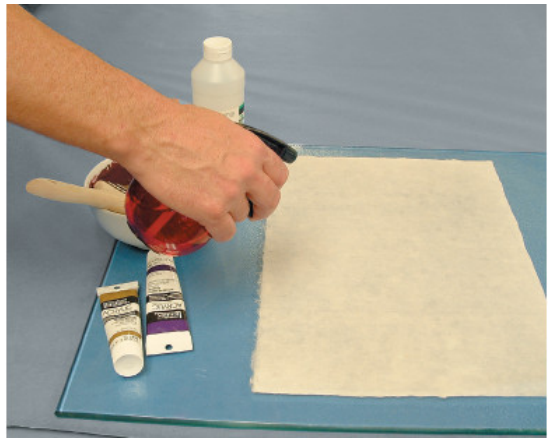


6. The finished, trimmed tissue-foil-tissue composite, ready for folding.

Adding Surface Color to a Sheet of Paper

For some models, simply adding a certain color greatly enhances the overall look of the finished product. When you cannot find duo paper in the colors you want, coloring the back of a sheet yourself is an easy solution.

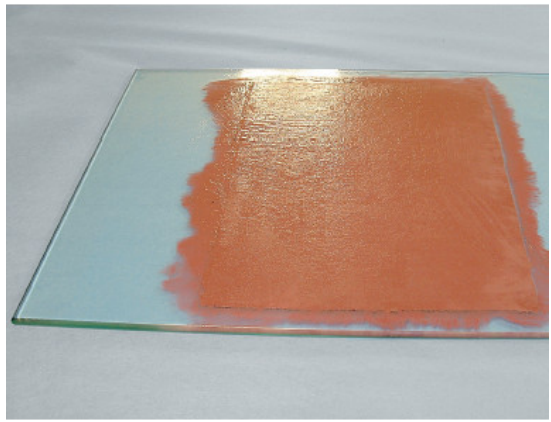
1. To add surface color to paper, you will need these supplies: liquid acrylic polymer emulsion (blending fluid medium), artists' acrylic paints (in tubes), wide brush, bowl, 10 percent methyl-cellulose gel emulsion (in bowl), plant mister and paper. A piece of glass on which to lay your work may also be useful.



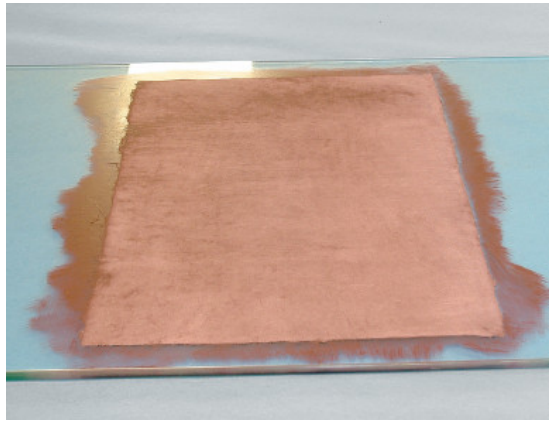
2. Moisten the paper, front and back, using the mister.

3. Mix the acrylic paints. Blend equal amounts of the paints with the methylcellulose gel. For every 30 grams of paint, use 5 grams of emulsion.

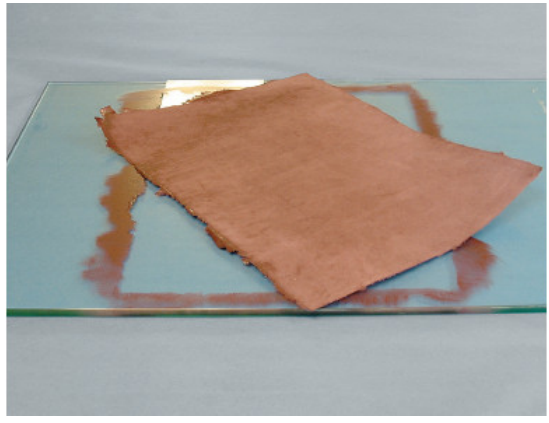
4. Brush the acrylic colorant onto the paper, spreading it evenly from the center to the edges.



5. After application, smooth out the brush strokes.



6. Allow the paint to air-dry.

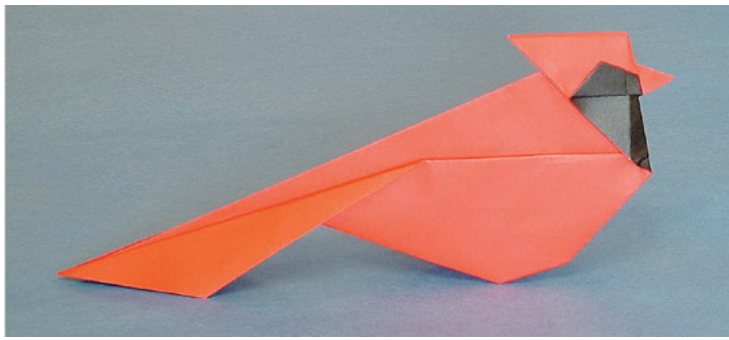


7. Separate the colored sheet from the glass. Adding additional coats will darken the color and increase stiffness.

Projects

north american cardinal

Designed by Michael G. LaFosse



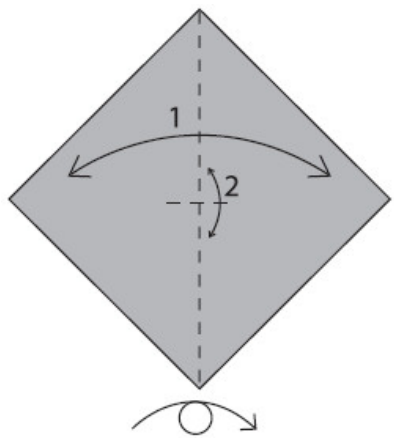
This crested, brightly colored finch is a favorite that every person putting out a backyard bird feeder hopes to attract. No wonder seven states have chosen it as their state bird. This model shows a modern design using the older origami style of creating flat profiles of familiar objects. The beautiful simplicity, harmony of shapes and proportions makes this model elegant, yet deceptively sophisticated. The model also reduces the subject to a minimalist abstraction. The design takes advantage of two-toned, or duo, paper that is all red on one side, all black on the other. The folding process or sequence is direct, economical, interesting and enjoyable.

Even as a youngster, I was smitten with the cardinal. I remember begging my parents for a plastic cardinal model kit that I could assemble and paint by myself. They did not buy it for me, but shortly afterward Santa Claus did. I tried for several

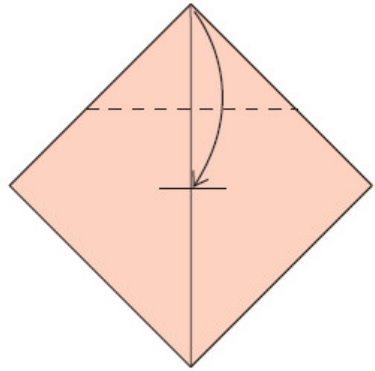
years to design a fitting origami rendition of my favorite bird but did not succeed until Richard asked me to determine the land marks on my Mourning Dove so that he could teach it to beginners at the Origamido Studio. Although I never finished land marking the Mourning Dove, during the process I did discover the potential to reshape the bird's head and to explore the opportunities to accomplish a color change. My vision for the origami cardinal years ago was for a fully three-dimensional bird, just like the plastic model that I had glued together and painted as a child. The resulting flat fold is quite a departure, yet every bit as satisfying to me because it has a pleasing geometry and harmony that gels. Like a wonderful poem that everybody can recite and understand, it has an honest quality in its simplicity, even though it is folded flat.

PAPER SUGGESTIONS

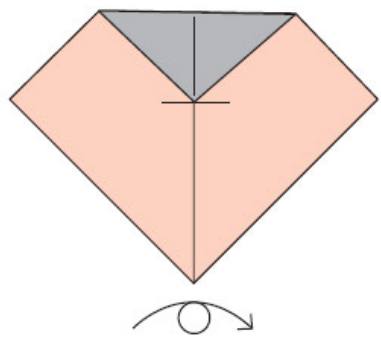
The paper must be red on one side and black on the other. This so-called "duo" origami paper is generally available in standard 5⅞-inch (15-cm) squares (yielding a 5½-inch [14-cm] bird) and 9¾-inch (24.7-cm) squares (yielding a 9-inch [22.8-cm] bird). Some popular packs of assorted duo color origami papers include a couple of sheets of red/black paper. You can also make your own duo paper using the techniques described in this book. For best results, swipe a little moisture along the diagonal before you make the first fold.



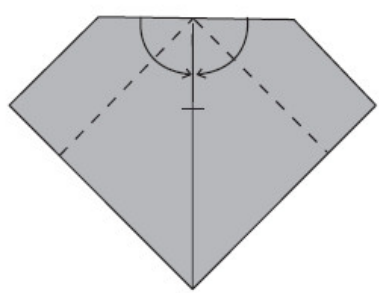
1. Begin with the black side up. Fold in half, corner to corner. Unfold. Make a pinch mark halfway up the crease to mark the center of the paper. Turn over.



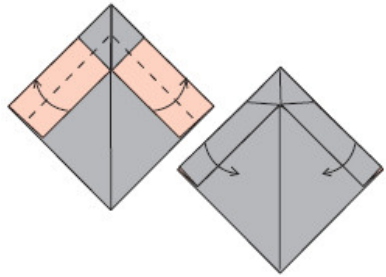
2. Fold one corner to the center. Be sure to use a corner that has a crease line running through it.



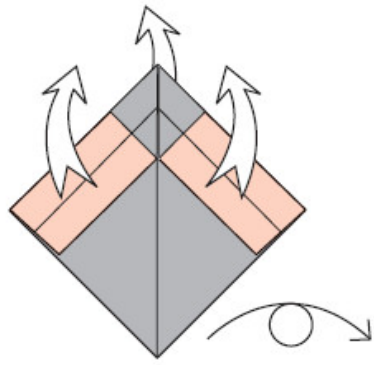
3. Turn over, left to right.



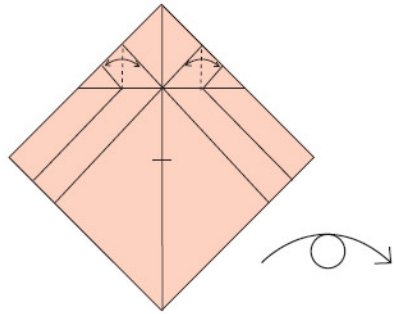
4. Fold each half of the folded edge to meet at the crease.



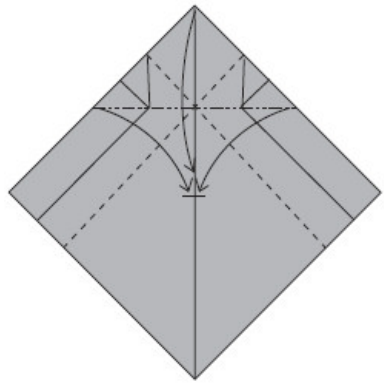
5. Fold the free red edges to the outside folded red edges. Unfold.



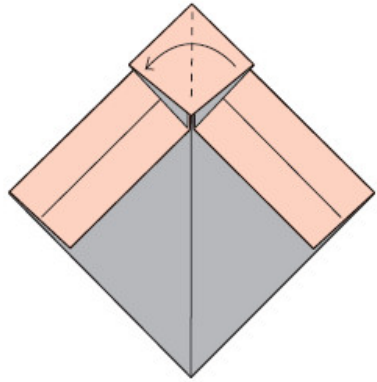
6. Open the paper completely and flip horizontally, red side up.



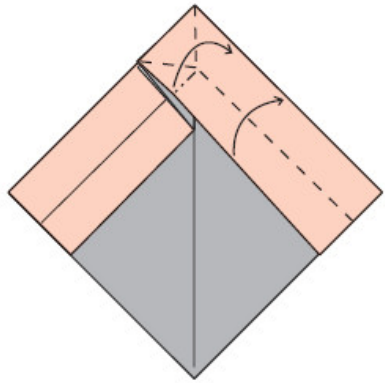
7. Perform the indicated valley creases. Carefully note their placement. Turn the paper over horizontally, black side up.



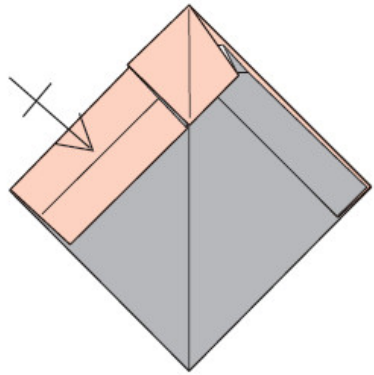
8. Use the existing mountain and valley creases to fold the top corner and edges down.



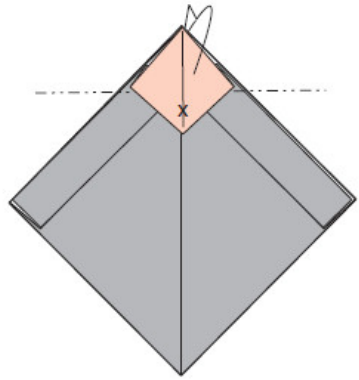
9. Your paper should look like this. Fold the top right corner to the left.



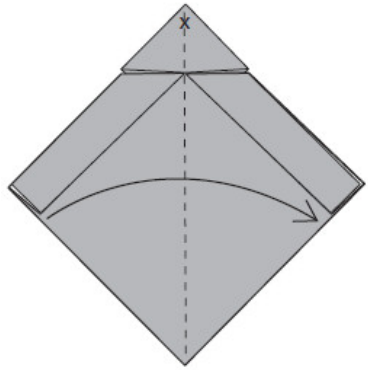
10. Move the long cut red edge to the outside red folded edge. Inside-reverse-fold the upper portion of this layer as you return the corner to the right. The small crease installed in step 7 will aid this maneuver.



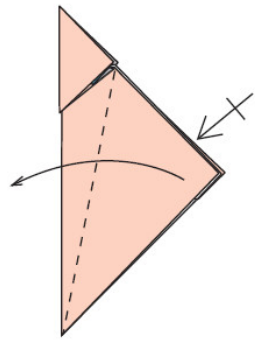
11. Repeat on the other side.



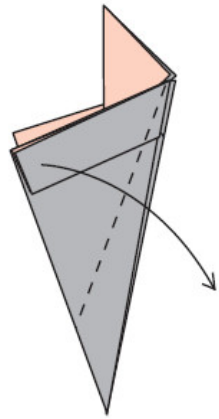
12. Fold the top corner behind. Watch the “X” spot! You are actually toggling the red diamond upside down and over to the other side. This will be the head.



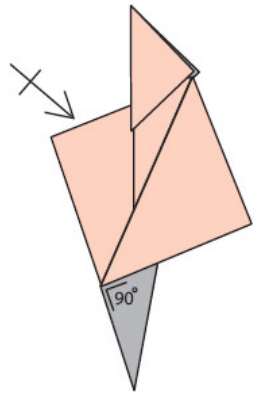
13. Fold in half.



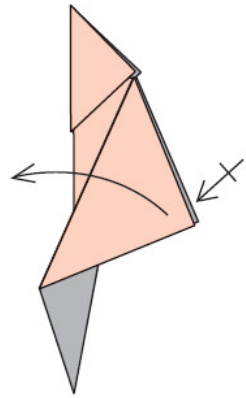
14. Fold the corner to the left. Repeat behind.



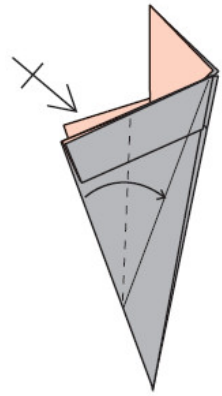
15. Fold to the right. Look ahead at step 16 and notice the 90-degree angle that is formed when the paper is properly placed.



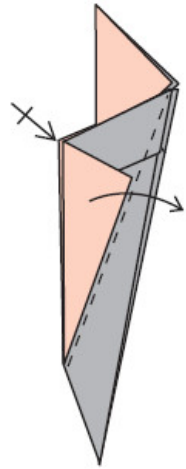
16. Repeat behind.



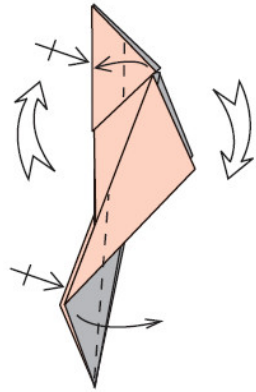
17. Unfold, front and back.



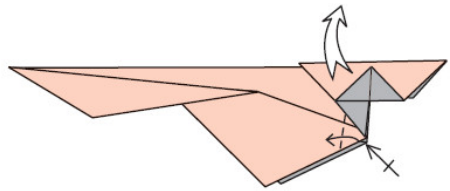
18. Fold the cut edge to the crease. Repeat behind.



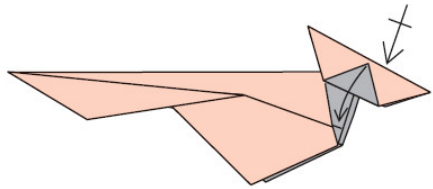
19. Using the existing crease, fold over. Repeat behind.



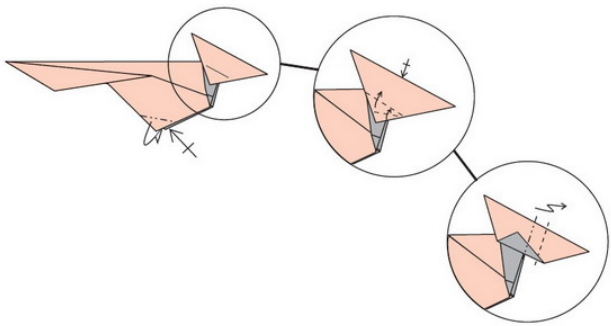
20. Fold the free square corners of the head to the middle of the folded edge. Fold the free red and black corners of the tail over, covering the black paper completely.



21. Pull up on the back corner of the head (crest) and swivel the black paper at the front of the neck, changing the angle and displaying more black paper.



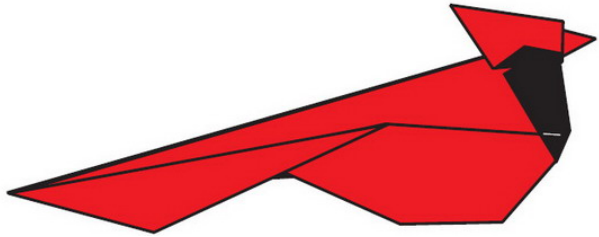
22. Bring down the corners on the head.



23. Mountain-fold the bottom corners inside.

24. Fold up the bottom front edge of the head paper, aligning it to the crease. Repeat behind. Fold up the bottom front edge again along the crease. Repeat behind.

25. Mountain- and valley-fold the front of the head to form the beak.



26. The finished North American Cardinal.

origamido butterfly

Designed by Michael G. LaFosse

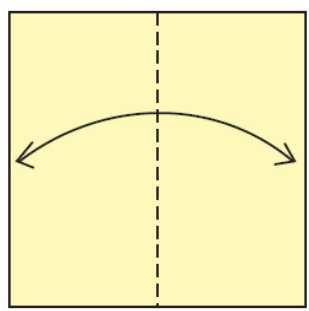
Alice Gray, an important origami pioneer, was also an entomologist at the American Museum of Natural History in New York City at the same time I was visiting Lillian Oppenheimer's Origami Center of America. We shared a subway trip from Lillian's apartment to the museum, and inspired by Alice's vocation I spontaneously folded an origami butterfly from a discarded piece of letter paper for her. Alice critiqued my creation and lamented that it was not from a square, since the general feeling amongst origamists in the 1970s was that all good origami must be from an uncut square. Since this design required a non-equilateral rectangle, I realized it was easy to start with a square, and simply fold one or more of the edges inward. As a bonus, the extra

paper folded inward at the first steps could be fashioned later to produce interesting shapes and patterns in the final steps.

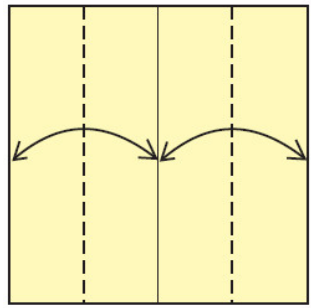
This design is actually a system of generating dozens of species of butterfly simply by mixing and matching several possible options at each of the first few steps. We have included this model to encourage creative play using origami. See if you can think through the final effect of making a particular change at an early step in the folding.

PAPER SUGGESTIONS

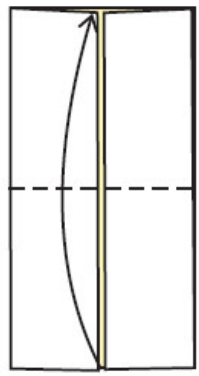
When using duo paper, the body will be colored differently from the wings. Although there are many duo papers prepared for the origami hobbyist, you can make your own duo papers by painting one or both sides of the sheet so that they are different. Almost any paper can be used as a base sheet. Let your imagination soar! You can apply any coloring or decorating techniques that you wish: tie-dye, sponge, spray, stamp, pencil or crayon. You can even run paper through a color printer! Just make a colored area in a graphics application and print. Flip the printed paper over and repeat with a different color, then cut out a square shape for folding. Another method of making duo paper is to paste two different sheets together. If you are making handmade paper, you can form two sheets, each a different color, and press them together, back to back. When dry, they will be a duo sheet.



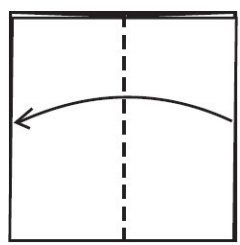
1. Begin with the color desired for the wings facing up. Fold in half, edge to edge. Unfold.



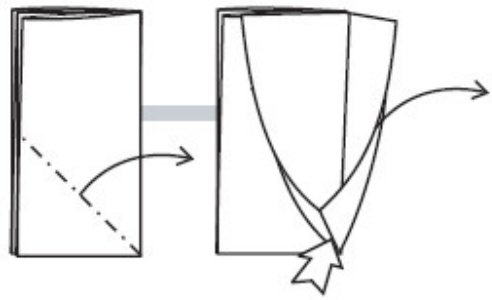
2. Fold the left and right edges to the crease.



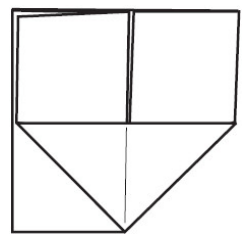
3. Fold in half, short edges together.



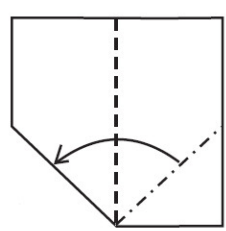
4. Fold in half, right-side double folded edges to the left.



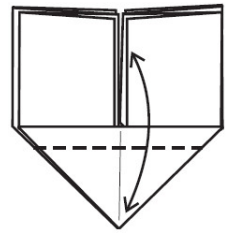
5. Squash-fold the bottom corner.



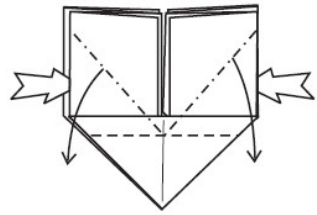
6. Your paper should look like this. Turn over, left to right.



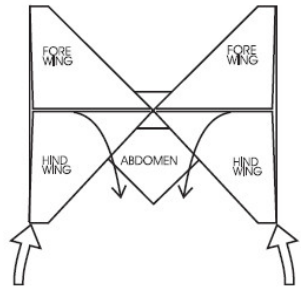
7. Squash-fold the bottom corner.



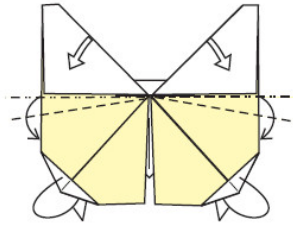
8. Fold up the bottom corner, about a quarter way down from the middle folded edge. Unfold.



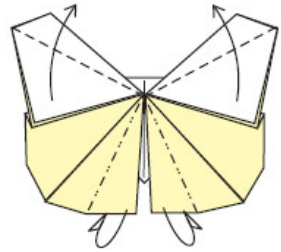
9. Squash-fold the upper left and right sections, being careful to make the squash creases hit the center of the folded line made in the previous step.



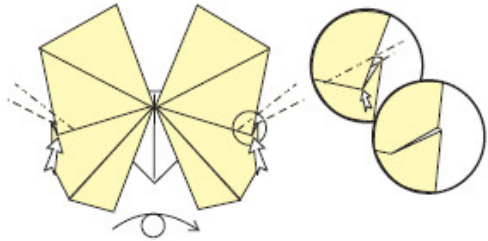
10. Your paper will look like this. With the abdominal corner at the bottom, move the top layers of the hind wings down, squash-folding the bottom corners of both wings.



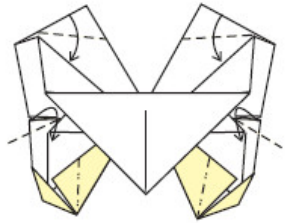
11. Form a mountain crease edge across the middle of a wing and move it downward, reshaping the forewing and defining a separation between the forewings and hind wings. Repeat with the other wing. If desired, turn the triangle of paper on each hind wing inside out.



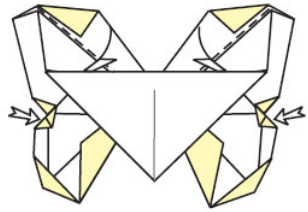
12. Mountain-fold the hind wing edges under to reveal the abdomen. Fold up the top layer of the forewings.



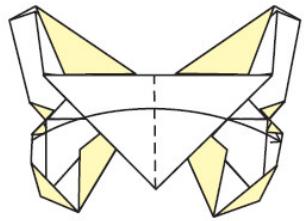
13. Inside-reverse-fold the indicated corners at the separation point of the forewings and hind wings. Turn over, left to right.



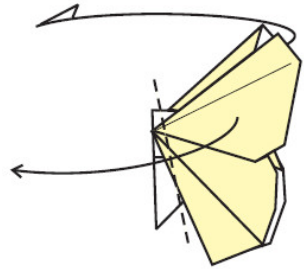
14. Clean up the back side with the indicated folds. You can be creative with the shapes of the top folds and the mid-side folds.



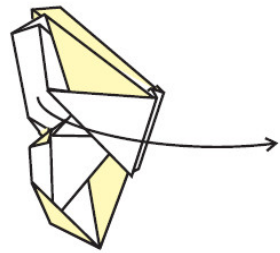
15. Fold the top edges inside. Notice the notches created at the mid-side points.



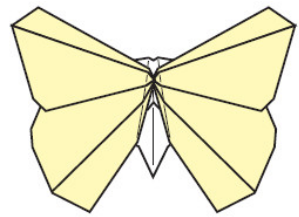
16. Fold in half.



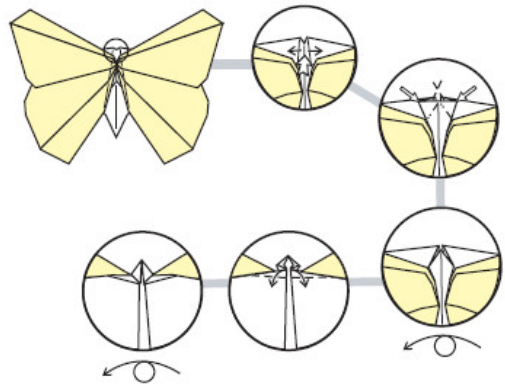
17. Fold each wing set against the body, one to the left and one to the right. You can be creative with the angle.



18. Open, display side up.



19. Your model should now look like this.



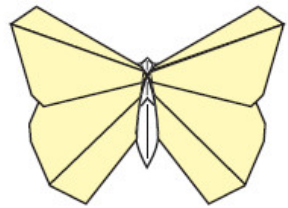
20. Head detail. Squash-fold the center rib in the head area.

21. Inside-reverse-fold the top corners, left and right.

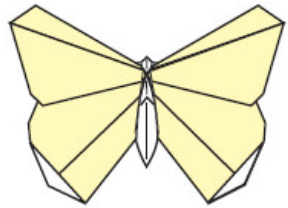
22. Turn over, left to right.

23. Fold the edges down.

24. Turn over, left to right.



25. The finished Origamido Butterfly.



26. This version leaves the triangle layer displayed upon the hind wings.

koi

Designed by Michael G. LaFosse

The word koi *is an abbreviation from the Japanese description* Nishiki Goi, *meaning "fish as beautiful as colorful cloth." Koi are a particular kind of cultivated ornamental carp highly valued for their coloration and markings.*

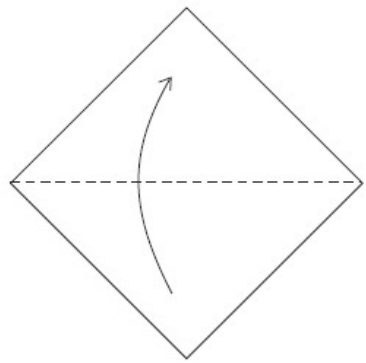
I designed this origami koi in the 1970s, immediately after watching them at a pond for the first time. Their graceful antics still amuse, inspire and relax me and I can watch them for hours. Although I was satisfied with the form of my origami koi, I realized that a color-change origami model would be hideous, and would fail to faithfully capture the magic of these engaging fish. Since koi are primarily valued for their splendid coloration and markings, I actually painted designs on the backs of my first origami models. Then, inspired by the Japanese art of chigiri-e, *which uses torn paper to compose pictures resembling watercolor paintings, I applied patches of vibrantly colored handmade*

papers to my later origami koi. I designed this model to be viewed from above, just as if you were looking down through the water at them, gazing into the pond from a stepping stone.

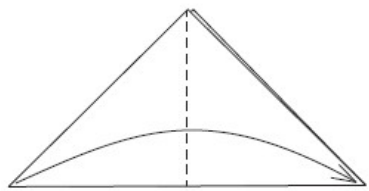
At the Origamido Studio, our panels with koi have been some of the most popular pieces of art. We often arrange a small group of these origami fish to represent their gregarious social behavior. The versatility of combining origami and chigiri-e has also allowed us to work from photos sent to us by koi fanciers. We represent the actual prize-winning, brightly colored koi in origami, mounted on background panels of gampi—decorative handmade paper, pressed with inclusions of coarse vegetation strands.

PAPER SUGGESTIONS

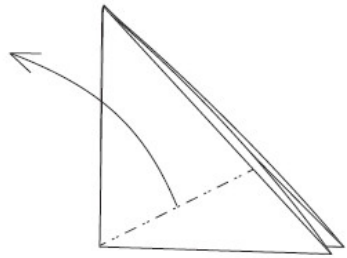
For best results, use a bright, white, 100 percent cotton cold-pressed water-color paper. It should be lightweight, only up to 140 lb. Cut it square, from 12 to 20 inches (30.5 to 50 cm). Your koi will be 60 percent as long as the side of the square you choose. Pulp appliqués can be torn pieces of hand-made papers. Red and black are traditional. To paste them on the finished model, use a light mist of water to dampen both sides of the paper. Brush the droplets into each of the paper's surfaces evenly. Do not brush the paper too hard since this will change the surface texture. Apply paste sparingly and place the shapes on the back of the koi.



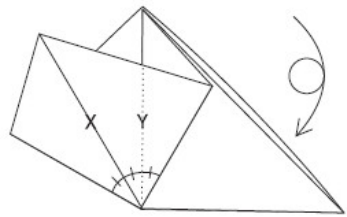
1. Fold in half, corner to corner.



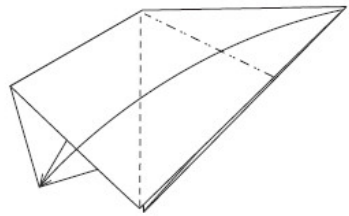
2. Fold the triangle in half, corner to corner.



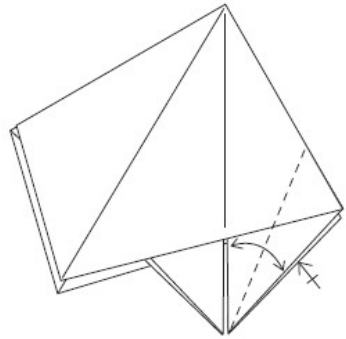
3. Swivel and squash to form a flap with three equal segments. The layer beneath will help you adjust the thirds.



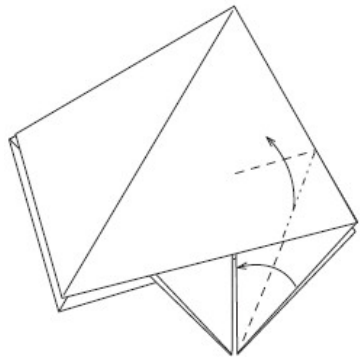
4. Check by folding at "X," which should bring the right edge over the hidden line"Y." Adjust if necessary. Turn the paper over, top to bottom.



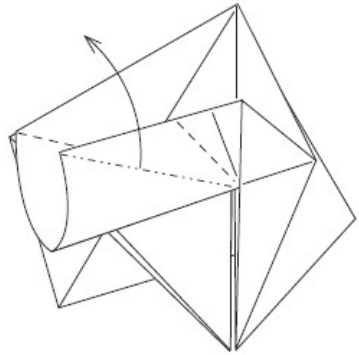
5. Repeat the same folding process on the other side. (If you are wet-folding, don't expect the paper's points to match.)



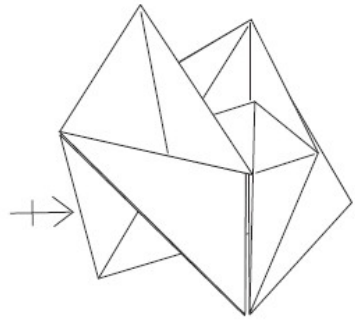
6. Fold and unfold the top right edge to the center. Repeat on the back.



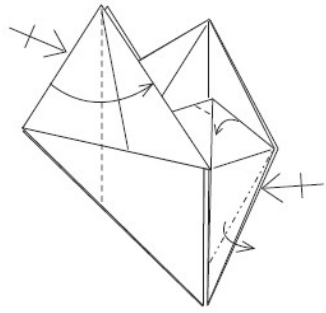
7. Move the right side of the top layer up while bringing the bottom right edge of the second layer to the vertical folded edge. Flatten the top layer only to the right of the centerline.



8. Form a mountain crease from the corner of the top left flap to the center of the paper. Swivel the flap up and flatten.

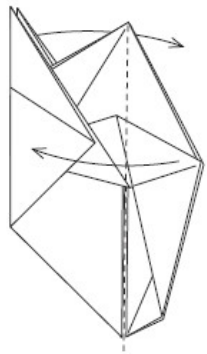


9.Repeat steps 7 and 8 on the other side.

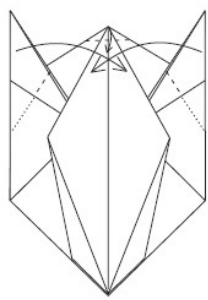


10. Valley-fold the left edge. Repeat on the back. Swivel the top right layer

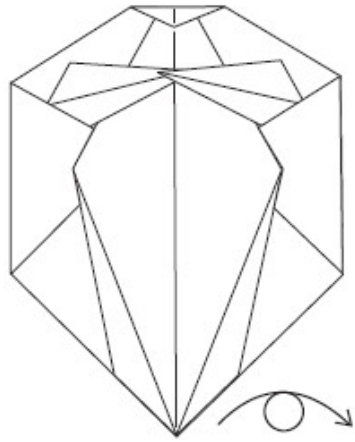
down and to the right. Repeat behind.



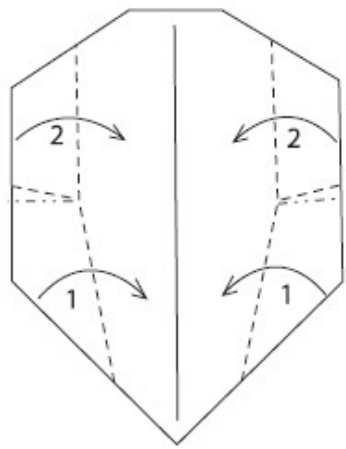
11. Rearrange the layers as follows: top right to the left and back left to the right.



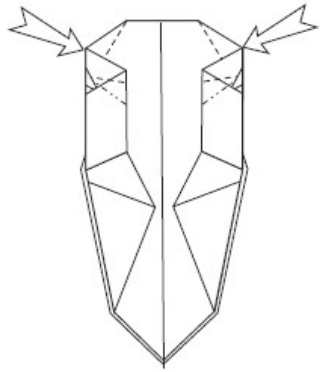
12. Your paper should look like this. Fold the top corners over so they cross. Notice that the fold continues under the covering layer at the base of each point.



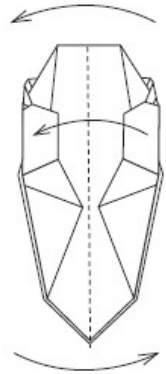
13. Turn the model over, left to right.



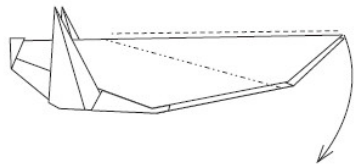
14. Fold in the lower side edges, then fold in the upper sides, forming a crimp between each upper and lower side.



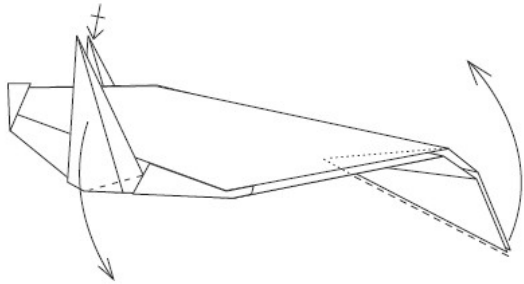
15. Narrow the front with an inside-reverse fold on each corner.



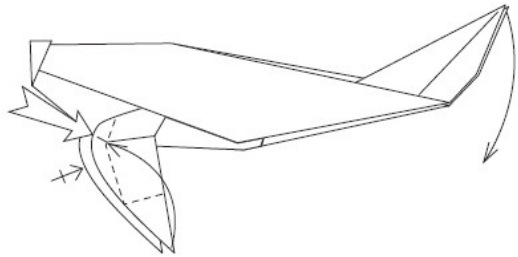
16. Fold in half and rotate the top to the left.



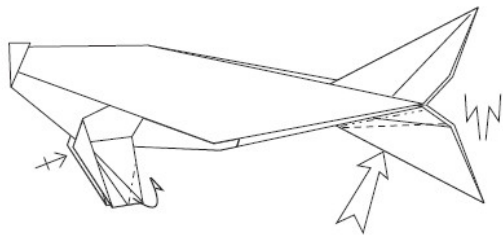
17. Inside-reverse-fold the tail layers downward.



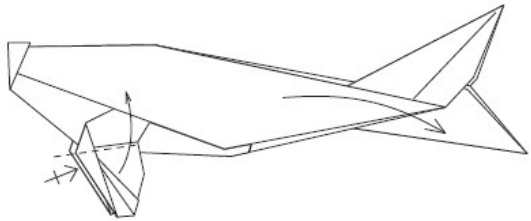
18. Inside-reverse-fold both tail layers upward. Fold the front fins down on each side.



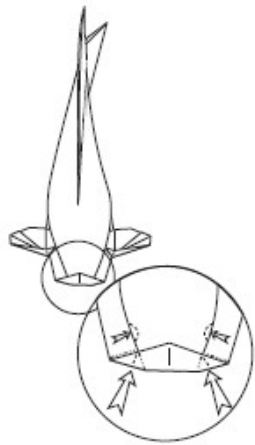
19. Separate the top and bottom tail layers and inside-reverse-fold the bottom one down. Squash-fold the leading edge of the pectoral fins, and then tuck the tips inside the base of each fin.



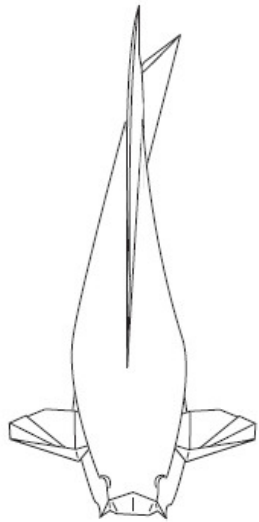
20. Crimp the lower tail near the body. Mountain-fold the back corner of the front fins.



21. Curl the rear of the fish and tail to one side or the other. Fold the front fins upward.



22. Shape the mouth by mountain-folding the edges of the upper sides of the lip. These will be the barbels or whiskers. Use your thumb and index finger to curl the lower edge while forming an outward twisted pucker at the upper side of each lip, near the cheeks. Make eyelids by forming curved creases in the folded edges on top of the head.



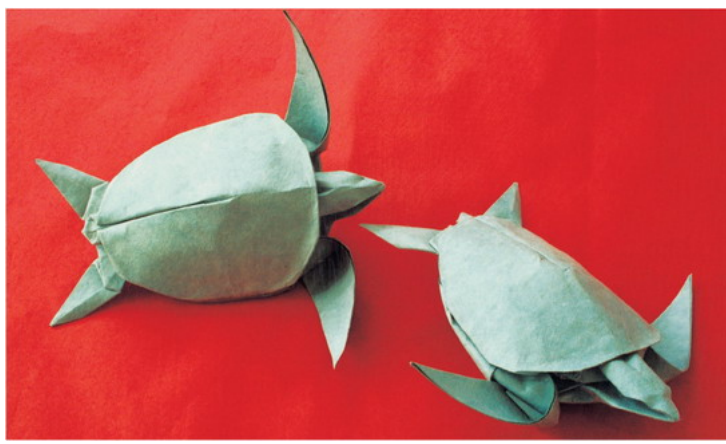
23. The finished Koi. Add color patterns with torn paper shapes of red and black.

ADDITIONAL HINTS FOR ADDED DETAIL

- Inside-reverse-fold the edge of paper from the barbel to the fin. Form a mountain fold to intersect the corner of the paper. Lock the layers by turning the edges of the corners underneath. Repeat on other side.
- Narrow and round out the belly by folding the free edges inside the model, all along the model, and up into the tail area. Repeat on the other side.
- Heavy paper will require more effort.Push the corner near the tail flat to form a mountain and a valley fold to lock a more slender shape. The mountain fold is toward the head, the valley fold toward the tail.
- Twist the paper away from the front to form the eye. Gently curve a dimple above the mountain fold at the eye to accentuate the eye, and insert another dimple behind the eye to suggest the gill area.
- To help the koi to dry in shape when wet-folding, restrain the tail area with clothes pins padded with paper napkins.

sea turtle

Designed by Michael G. LaFosse



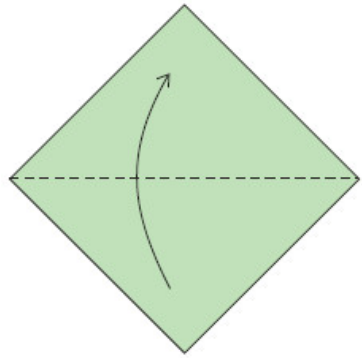
One of my favorite natural history subjects is the turtle, and the sea turtle is the most elegant of them all. Imagine this huge yet graceful creature free to roam the reefs in every sea with few predators to fear. The New England Aquarium features a large ocean tank at its heart filled with hundreds of fish, yet visitors seem to enjoy watching the sea turtles more than any of the other creatures. I had the opportunity to dive in the great tank many years ago, and I will never forget these creatures' smooth surfaces and flowing lines, which enable them to glide through the water. Their immense forms dominated everything else around, making it impossible to focus on detail—just shape and form. Since I had seen the sea turtles under a depth of water where colors are filtered out, I usually fold them from blue-green paper.

Origami sea turtles were usually designed with

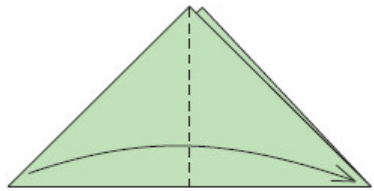
only the top shell in mind, but I wanted to design one with a plastron, or belly plate. The simpler the shape, the more skill required to animate the character of the model. The subtle grace you add to the curves will make the model speak to the viewer. This model was developed after I had created the Koi base, so my Sea Turtle and Humpback Whale are both derived from that base. Perhaps this versatile base will inspire you to create other sea creatures.

PAPER SUGGESTIONS

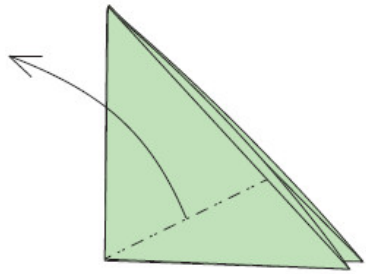
Paper choice, once again, is critical. Find paper that is stiff with sizing, pliable when moistened, yet able to hold a crease. Your sea turtle will be about half the length of the initial square. I suggest using 75 lb, 19-inch (48-cm) square cotton paper. You may practice dry-folding in tissue foil.



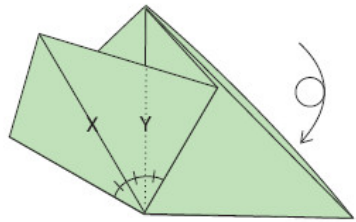
1. Fold in half, corner to corner.



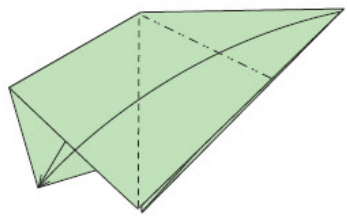
2. Fold the triangle in half, corner to corner.



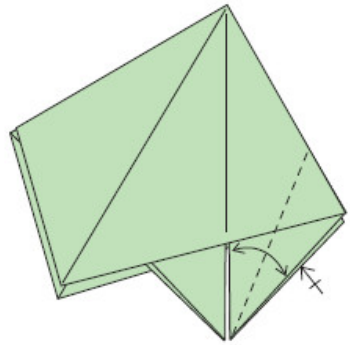
3. Swivel and squash to form a flap with three equal segments. The layer beneath will help you adjust the thirds.



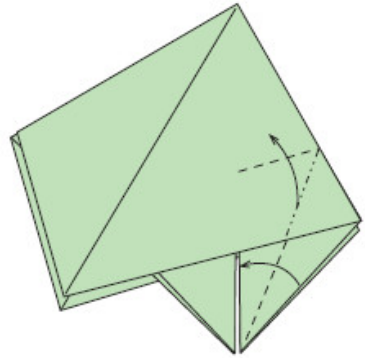
4. Check by folding at "X," which should bring the right edge over the hidden line"Y." Adjust if necessary. Turn the paper over, top to bottom.



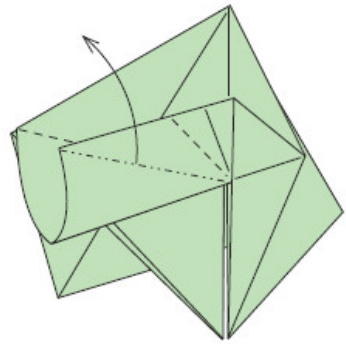
5. Repeat the same folding process on the other side. (If you are wet-folding, don't expect the paper's points to match.)



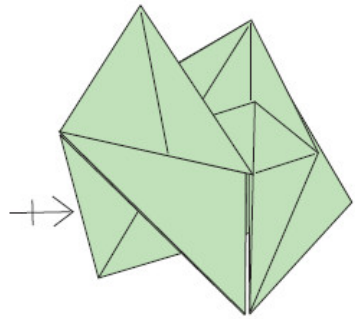
6. Fold and unfold, edge to center. Repeat on the back.



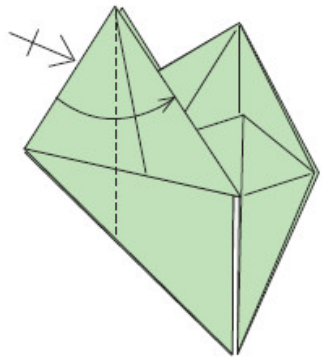
7. Move the right side of the top layer up while bringing the bottom right edge of the second layer to the vertical folded edge. Flatten the top layer only to the right of the centerline.



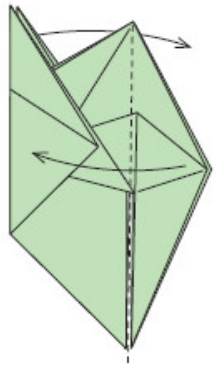
8. Form a mountain crease from the corner of the top left flap to the center of the paper. Swivel the flap up and flatten.



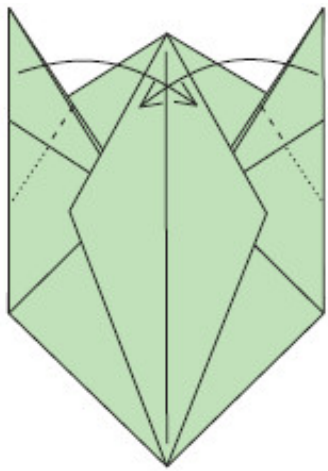
9. Repeat on the back.



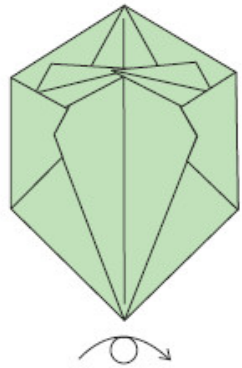
10. Valley-fold the left edge. Repeat on the back.



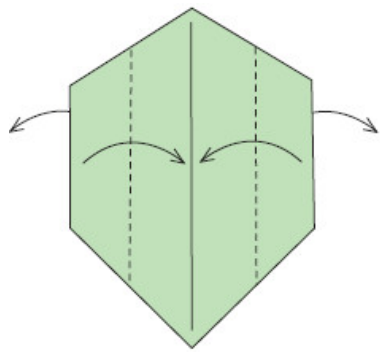
11. Rearrange the layers: top right to the left and back left to the right.



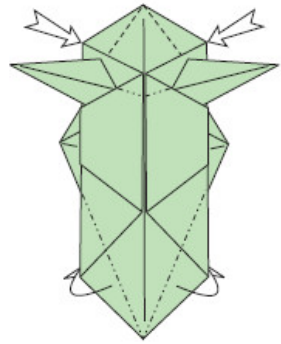
12. Your paper should look like this. Fold the top corners over so that they cross. Notice that the fold continues under the covering layer at the base of each point.



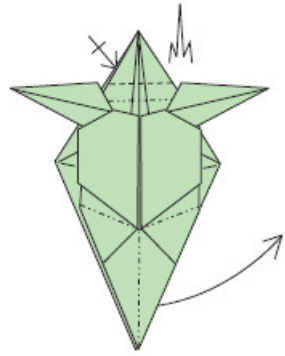
13. Turn the model over, left to right.



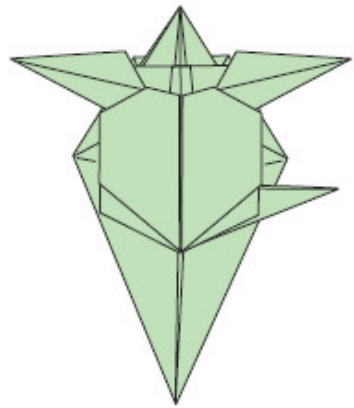
14. Bring each side to the centerline, allowing flaps to emerge from beneath each side.



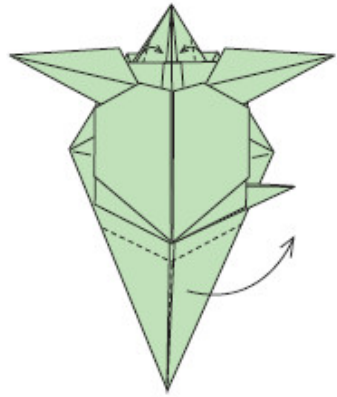
15. Mountain-fold the bottom edges of the bottom corners to narrow the point. Inside-reverse-fold the left and right side of the top corners.



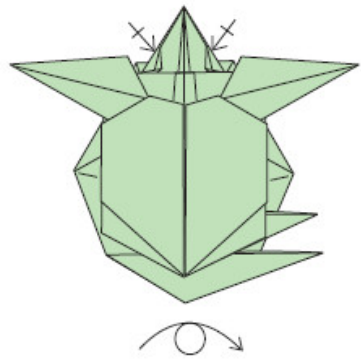
16. Crimp and sink the top point for the head. Mountain-fold the bottom point in half and flatten to the right for a rear flipper.



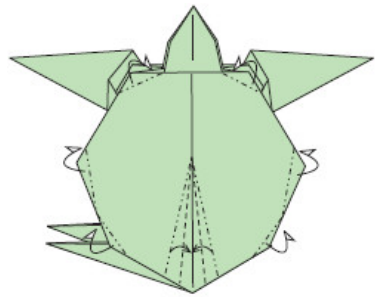
17. Belly view of the resulting hind flipper.



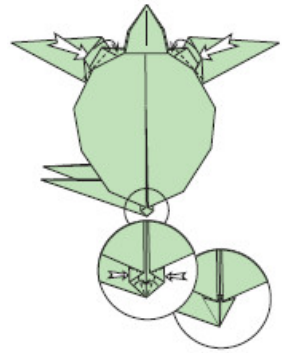
18. Valley-fold the bottom point in half and flatten to the right for a rear flipper. Note: Both rear flippers must point to the right. Valley-fold the base of the neck.



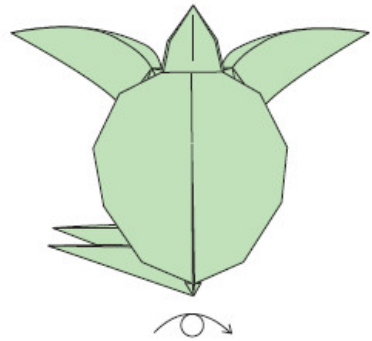
19. Narrow the base of the neck, pinching valleys and squashing. Turn over, left to right.



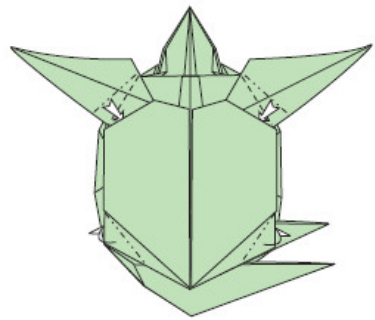
20. Form mountain and valley folds to create the upper dome of the shell. The mountain creases are valley-folded to meet at the center of the shell, making it cup. Round out the shape of the upper shell by tucking the corners beneath.



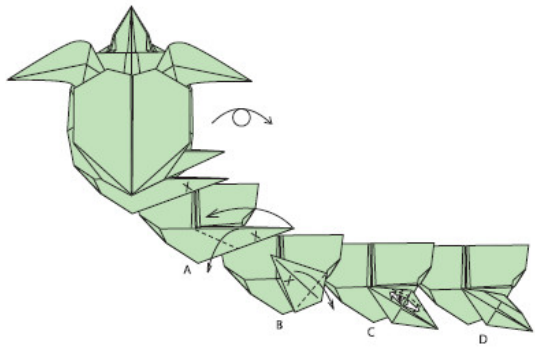
21. The end of the shell dart becomes the tail. Narrow the tail with inside-reverse folds. Fold the layers of paper at the shoulders tightly inside, making the front flippers curve gracefully.



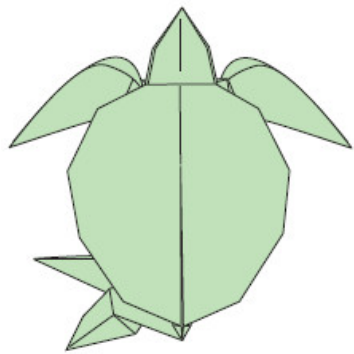
22. Turn over, left to right.



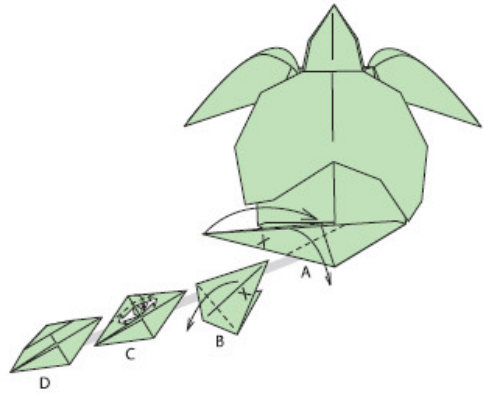
23. Tuck in the base of the undersides of the front flippers. Mountain-fold the bottom corners of the plastron(belly plate).



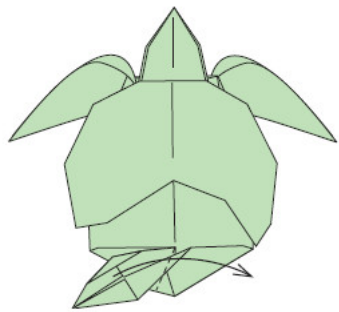
24. (A) Fold down the flipper, marked "X," and squash-fold. (B) Fold over. (C) Stretch the top edge of the flipper and fold down. (D) The completed flipper. Turn the model over.



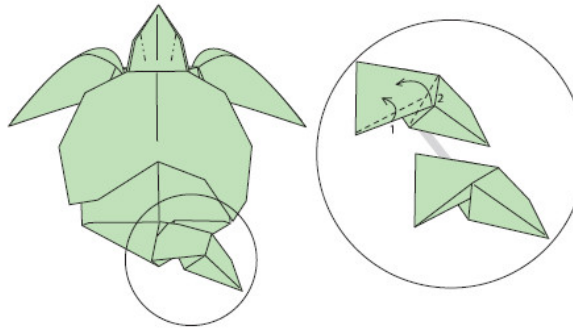
25. Top view.



26. Repeat shaping for the other rear flipper: Open the upper shell layer to expose the flip-per layers. (A) Fold down the flipper, marked “X,” and squash-fold. (B) Fold over. (C) Stretch the top edge of the flipper and fold down. (D) The completed flipper.

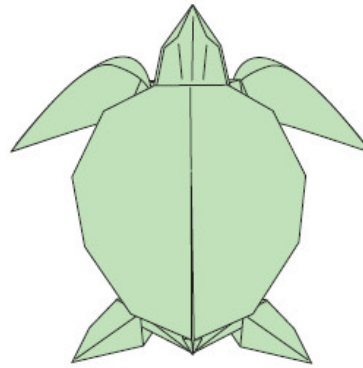


27. Fold the flipper across to the other side.



28. Pinch mountain creases in the head. Close-up view of the exposed flipper.

29. Fold up the edge marked "1," and then fold over corner "2." Repeat on the other flipper.



30. The finished Sea Turtle.

squirrel

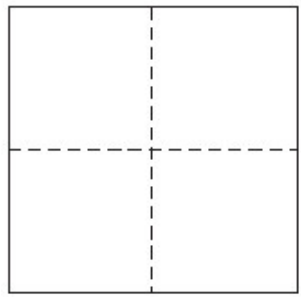
Designed by Michael G. LaFosse

The huge oak tree that shades the deck along the west end of my house produces enough nuts to keep the squirrels busy all season. If acorns were dollars, our squirrels would be millionaires. I designed this origami squirrel after watching one watch me work.

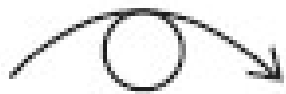
This is a good example of "inside-out" origami, a model that takes good advantage of both sides of duo (two-color) paper. The success of this model depends upon judging the proper proportions for the tail. Large and light, the tail must balance the whole creature, just as a real squirrel's tail enables it to leap gracefully from limb to limb over great distances. Notice how the delicate folding style about the head and ears reveals the essence of a real squirrel's head and face, with minimal indentations, just a hint of an eye or cheek.

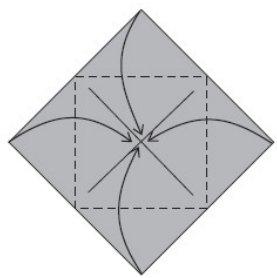
PAPER SUGGESTIONS

Use a 23-inch (58-cm) square piece of paper for a life-size model. Most squirrels in North America are gray, reddish or black, with a lighter shade on the belly. Use a duo paper or back-coat two sheets together to take advantage of this “inside-out” or “color-change” design.

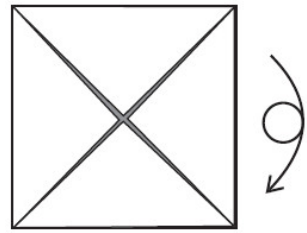


1. Begin with the lighter side up. Fold in half, edge to edge, both ways, and unfold. Turn the paper over.

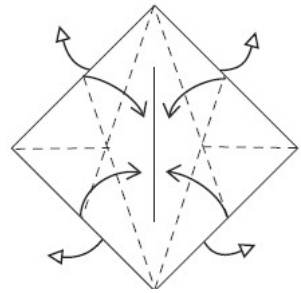




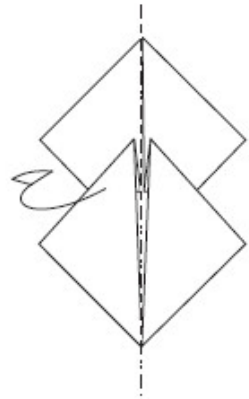
2. Fold all four corners to the center.



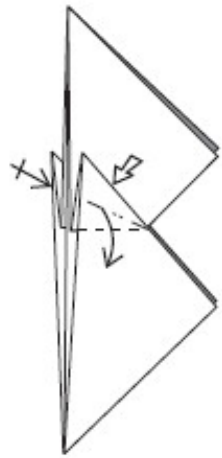
3. Turn over.



4. Fold the left and right corners in half. Fold each edge of the diamond to the vertical center crease. Allow the back corners to come out from behind.

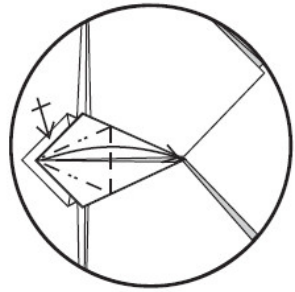


5. Mountain-fold the model in half.

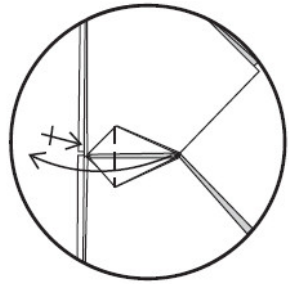


6. Squash-fold the middle corners, front and back.

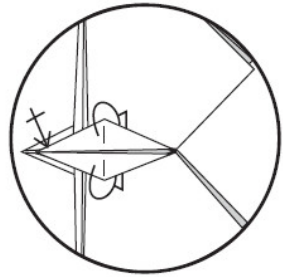
7. Zoom view to step 8.



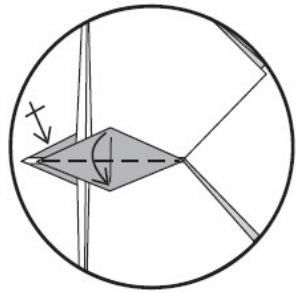
8. Petal-fold. Repeat on the back.



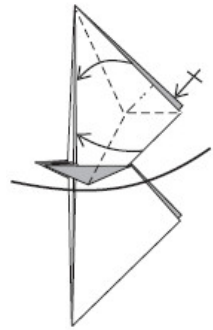
9. Bring the point back to the left. Repeat on the back.



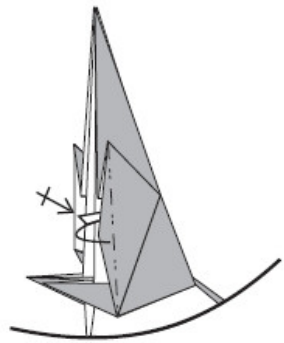
10. Color-change the diamond shape by turning the sides inside out. Repeat on the back.



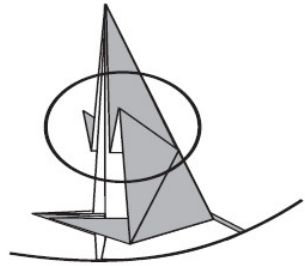
11. Fold the diamond in half, top corner to bottom. Repeat on the back.



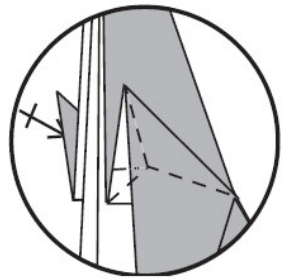
12. Fold the top right corner in half and align the edges to the left side of the paper. Flatten with the point up. Repeat on the other side.



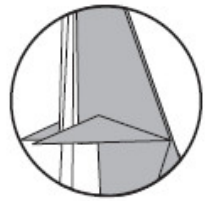
13. Tuck the excess paper inside to clean up the triangle. Repeat on the back.



14. Detail of upper arm (foreleg) points.

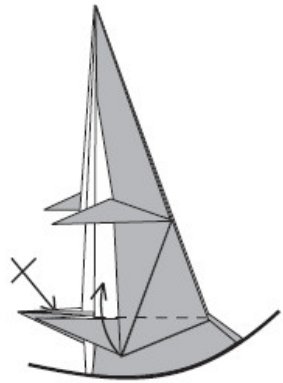


15. Fold the point in half and flatten to the left. Repeat on the other side.

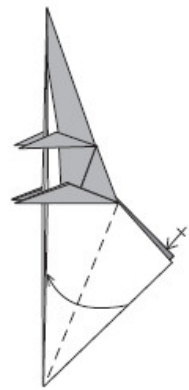


16. Detail of finished rabbit ear.

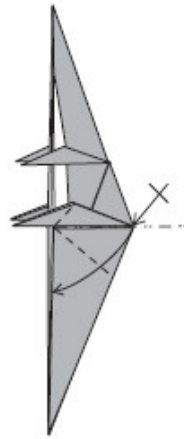
17. Fold in the indicated gray edge, exposing more white for the top of the chest. Repeat on the other side.



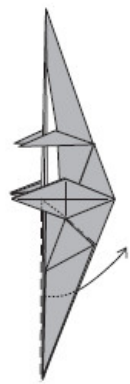
18. Fold up. Repeat on the other side.



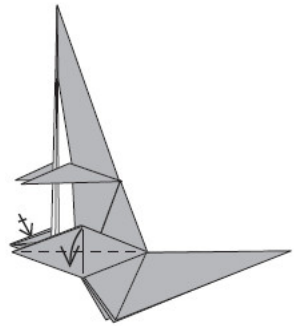
19. Fold in, edge to edge. Repeat on the other side.



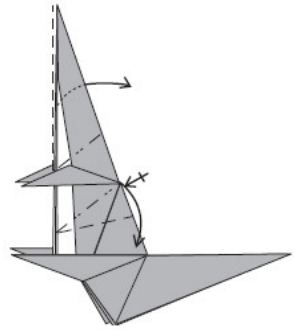
20. Inside-reverse-fold the free corner down. Repeat on the other side.



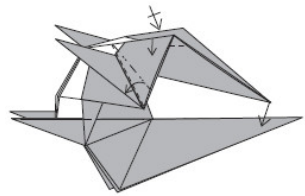
21. Inside-reverse-fold the large section of the tail paper up.



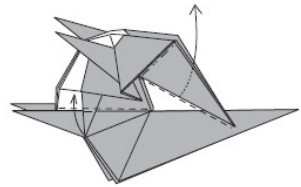
22. Fold the diamond in half, top corner to bottom.



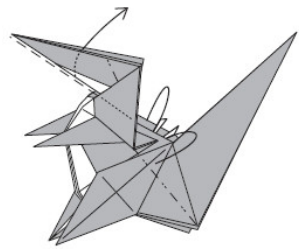
23. Begin a crimp at the belly, bringing the top of the shoulders near the top of the hips. Inside-reverse-fold the neck at the separation line above the front legs.



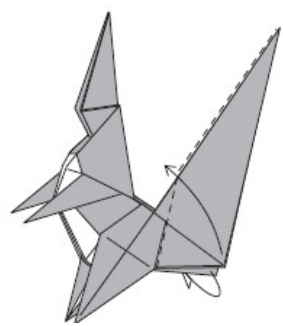
24. Mountain- and valley-fold just above the shoulders, swiveling the paper of the neck to narrow it.



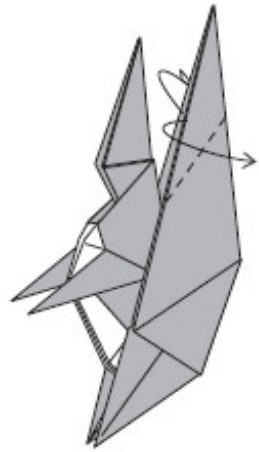
25. Inside-reverse-fold the head back through the neck area. Fold the hind leg halves up to open the diamond shapes once again.



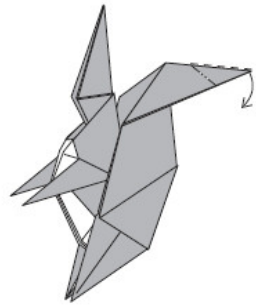
26. Inside-reverse-fold the top point up. Mountain-fold the excess paper inward, along a line from the top of the shoulders, along the top of the hips, to the base of the tail.



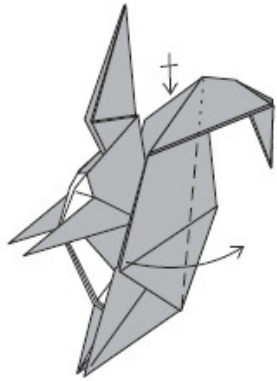
27. Outside-reverse-fold the tail.



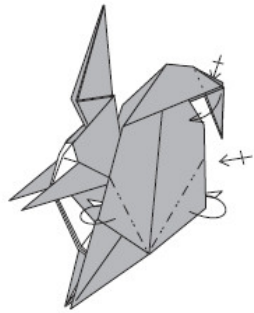
28. Outside-reverse-fold the top of the tail.



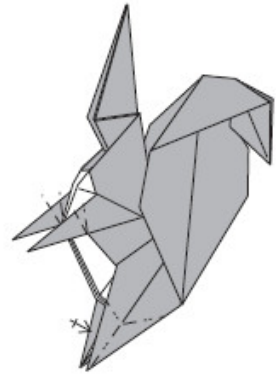
29. Inside-reverse-fold the tip of the tail.



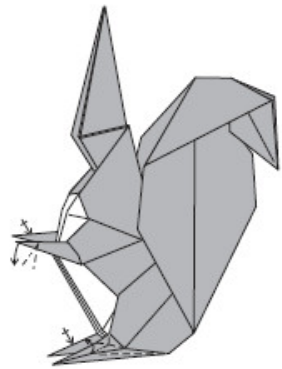
30. Bring back the outer layers at the base of the tail to make it wide.



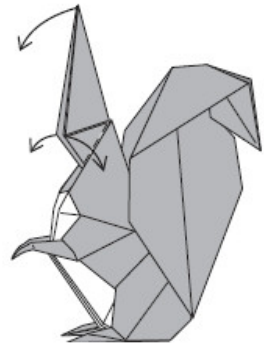
31. Narrow the base of the tail with a pair of mountain folds on each side. Open the layer of paper under the tip of the tail.



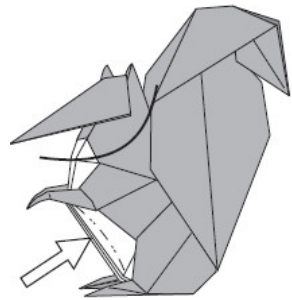
32. Crimp the elbows of the forelegs. Form feet from the ends of the lower legs with three intersecting mountain folds.



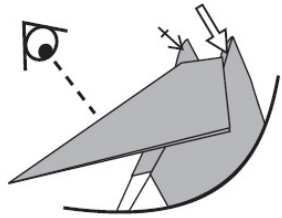
33. Form paws by crimping each forearm point. Adjust the stance with valley folds along the base of each foot.



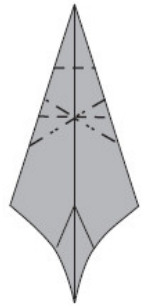
34. Divide the remaining head point with another inside-reverse-fold to form the corners of the ears. Crimp to bring the cheeks outside of the neck. Inside-reverse-fold again to make the top of the head. Bring the point back down to form the forehead and face.



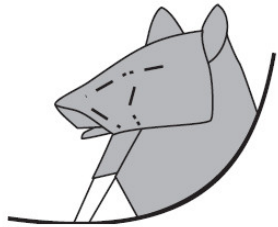
35. Round out the body. Reach inside the chest to push out the paper on either side of the valley fold. This will round the chest from the inside. Some of the paper may be pressed to one side or another to form a flatter looking chest.



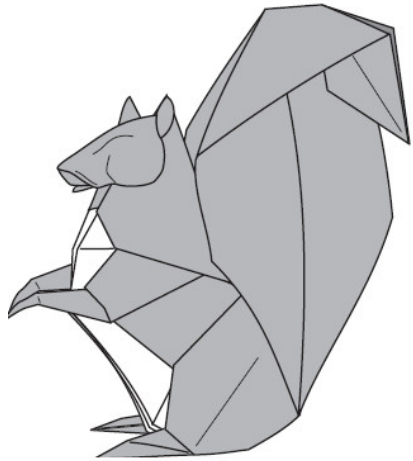
36. Open the ears.



37. View of head from above. Mountain-and valley-fold forward of the center to form the nose. Valley-fold the point to the tip of the nose.



38. Finish the head by bringing the triangular point forward of and between the ear points. Crimp to suggest eyes. Bring the point back out. Insert a pair of mountain folds, spreading them apart to form the upper parts of the nostrils. Squash the remaining triangular point to form the lower section of the nostrils. The point becomes the squirrel's lip.



39. The finished Squirrel.

ADDITIONAL HINTS FOR ADDED DETAIL

- Continue to re-wet and shape any of the major areas. Working on one area should allow the other areas to dry and firm up gradually. Check the edges and round out any areas of the tail profile to soften the appearance of the animal. The back of the tail and body may be formed and secured in a closed position.
- Check the angle of the feet so the model balances before it dries completely.
- Tuck the foot inside the leg at the ankle to adjust the angle of the foot. The model will stand upright.
- Pull the legs apart and reach inside the model to round out the body.
- Separate the chest and abdomen with an indentation as you puff out the chest.
- I often wrap the model with a piece of cloth while it dries in the correct posture. The cloth helps to stabilize the shape while it dries, otherwise it may drop open or sag out of form. You may want to stuff some paper towel or cotton behind particularly wet areas to keep them plump while they dry.

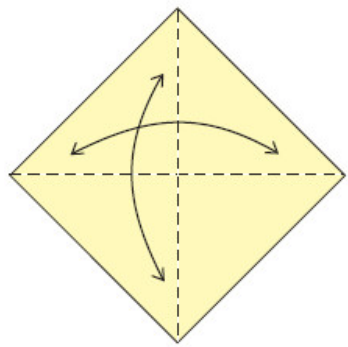
toco toucan

Designed by Michael G. LaFosse

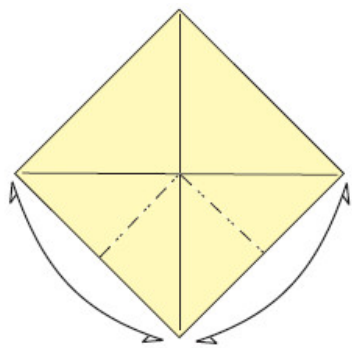
In 1991, a toucan resided in a pet shop near my home. I would frequently visit this bird during its month-long stay. Thus inspired, I designed this origami Toco Toucan model during that year.

PAPER SUGGESTIONS

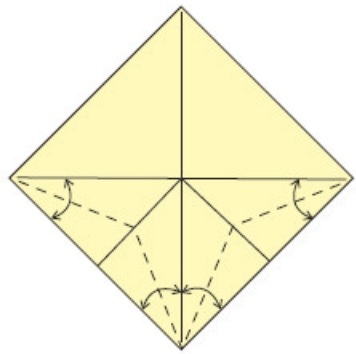
This is a good example of “inside-out” origami, a model that displays both sides of a two-colored sheet of paper (duo paper), yellow on one side and black on the other. Paper choice for this model is critical! Compressible Asian papers are best, such as washi. Paste two sheets together, one black and one yellow. Your final sheet must be large and thin since many layers accumulate in the legs and head. This model can be folded from smaller foil-backed and art tissue papers for practice. Use a piece of paper at least 25 inches (64 cm) square, which will produce a model 10 inches (25 cm) high.



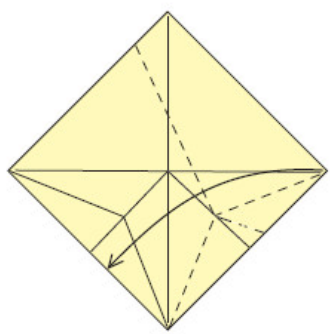
1. Begin with the yellow side up. Fold in half, corner to corner, both ways. Unfold.



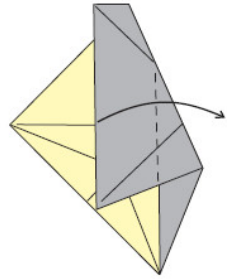
2. Mountain-fold the bottom two edges of the diamond in half. Unfold.



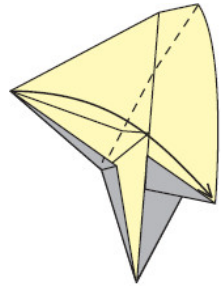
3. Valley-fold and unfold the indicated edges to their related creases.



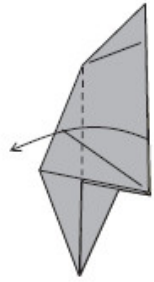
4. Move the right corner to touch the lower left edge of the diamond. Use the creases formed in step 3 to aid in placement. Fold flat. Look at step 5 for the shape.



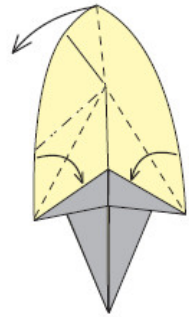
5. Valley-fold to the right. The crease should align with the center of the paper. The top corner should be folded flat.



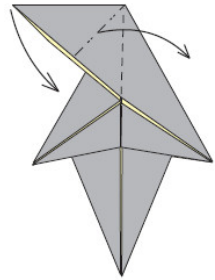
6. Repeat step 4 with the left corner, bringing it across to the right, using the existing creases.



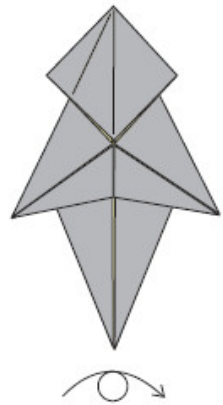
7. Open the paper by moving the top flap to the left, folding at the centerline.



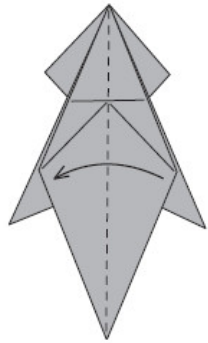
8. Fold the top corner in half and flatten to the left.



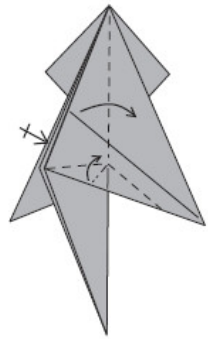
9. Squash-fold the top corner down.



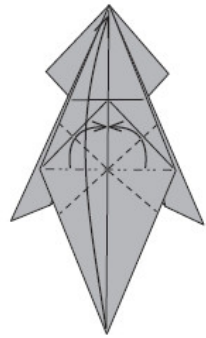
10. Your paper should look like this. Turn the model over, left to right.



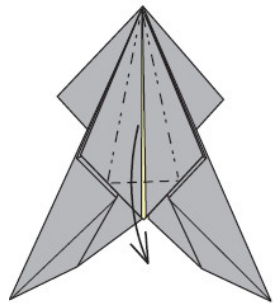
11. Move the right corner of the center diamond to the left.



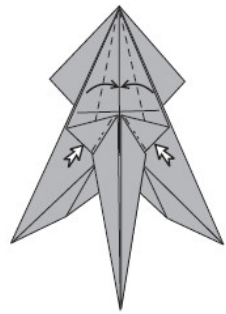
12. Push up on the lower edge of the right triangle as you bring the corner back, forming an inside-reverse fold. Repeat on the other side.



13. Inside-reverse-fold the left and right corners of the center diamond as you move the bottom corner to the top.

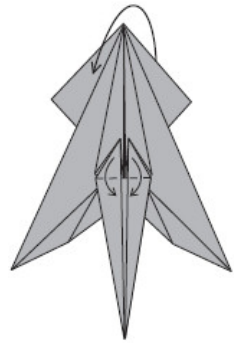


14. Mountain-fold the sides of the corner point to the center as you fold the point down. This is a petal fold.

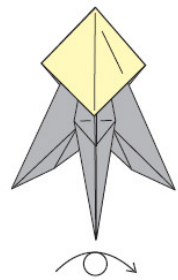


15. Narrow the upper part of the section to mirror the shape of the lower

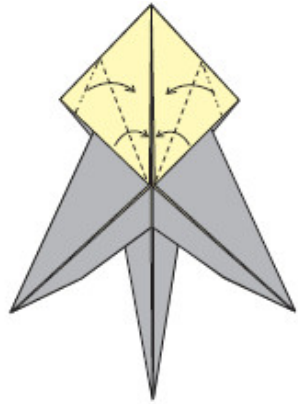
petal.



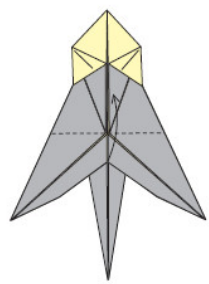
16. Turn the top point inside out. Fold the center points down.



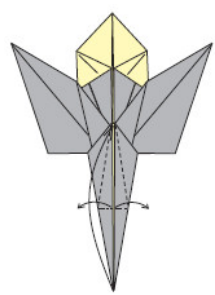
17. Turn the model over, left to right.



18. Fold the bottom edges of the yellow diamond to the center, squashing the left and right corners.

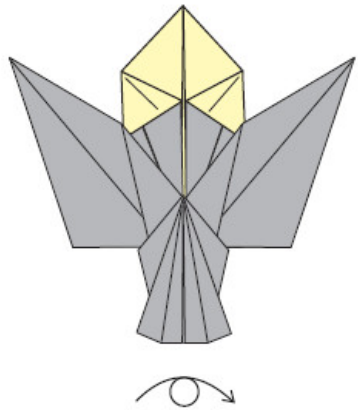


19. Fold up the wings.

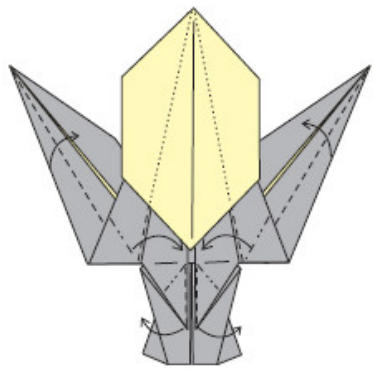


20. Fold the lower point up to meet the mid-point, pulling out on the mid-

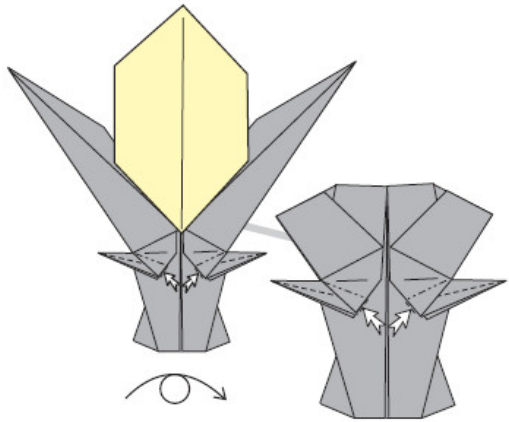
section to form the tail.



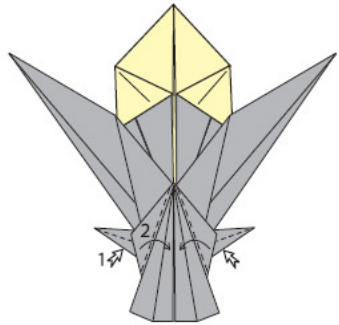
21. Turn the model over, left to right.



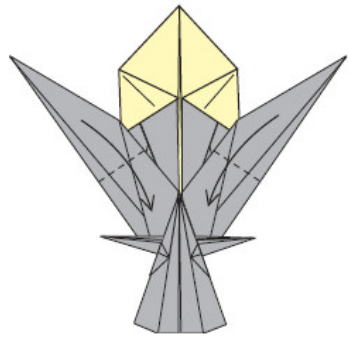
22. Fold in the upper layers at the bottom of the wings to meet at the center. Narrow the outside edges of the wings at the same time. Inside-reverse-fold the mid-points for the feet.



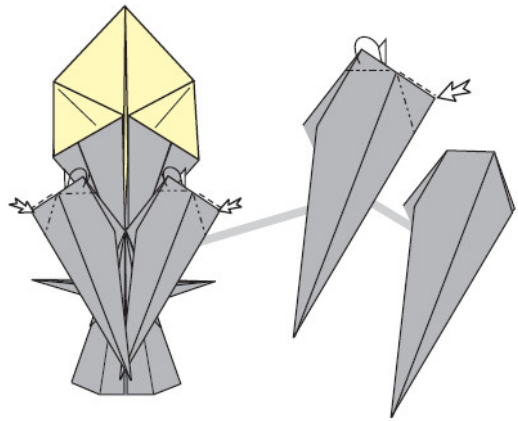
23. Inside-reverse-fold each point to narrow it. Turn the model over, left to right.



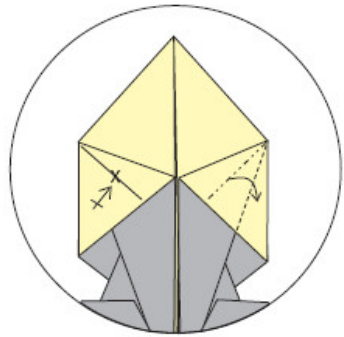
24. Inside-reverse-fold the feet. Fold the indicated edges over the top of the tail.



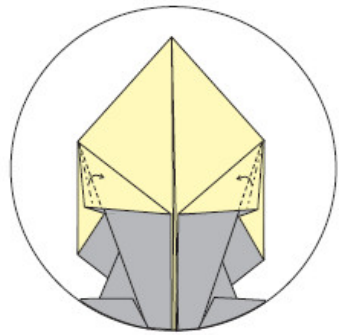
25. Fold the wing tips downward.



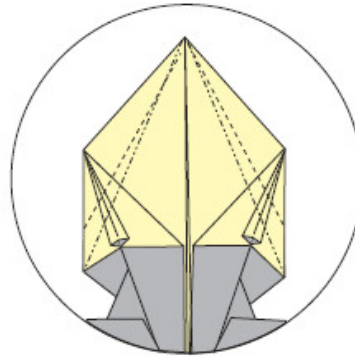
26. Tuck in each corner to form rounder shoulders.



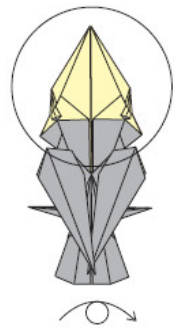
27. Pull more yellow outward from the folded flap by forming new mountain folds so that the yellow color extends straight across the model.



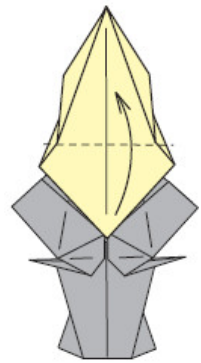
28. Squash-fold the indicated edges.



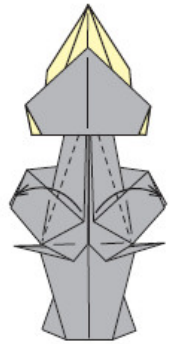
29. Mountain- and valley-fold the long edges of the beak.



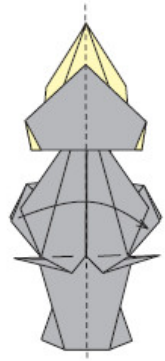
30. Turn the model over, left to right.



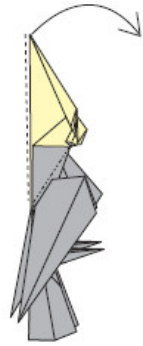
31. Fold up.



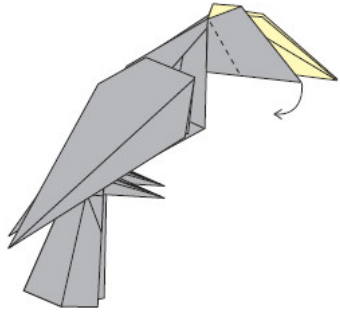
32. Bring out each corner from the center, forming valleys from neck to hips.



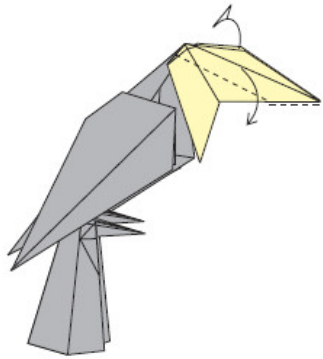
33. Valley-fold the model in half vertically.



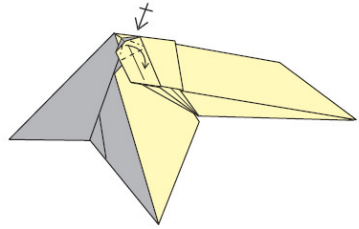
34. Inside-reverse-fold the head.



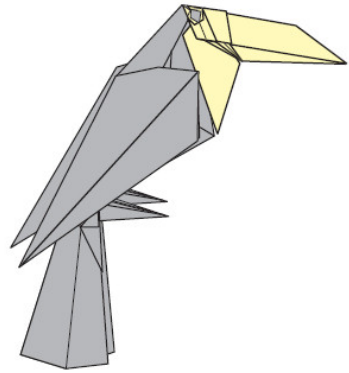
35. Outside-reverse-fold the black layer downward, exposing the yellow bib.



36. Pull to outside-reverse-fold.



37. Open, then squash-fold each eye.



38. The finished Toco Toucan.

frog

Designed by Michael G. LaFosse

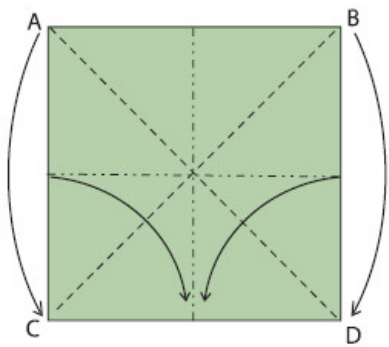
During my high school years, I spent summers with my good friends, the Rossi family, at their camp on Vinton Pond in northern Massachusetts. My friend Paul Rossi and I soaked up the wonders of this idyllic setting and we became students of the creatures in our own backyard. Vinton Pond was home to two of my favorite origami subjects, the turtle and the frog. These little frogs hid in the mud along the banks of the pond. The mud sparkled with mica, so when I created the handmade paper for this project I added mica to the paper. The resulting origami frogs closely resemble the real frogs as I saw them.

This design requires subtle sculpting along the back and eyes to make it appear particularly athletic—lean and alert—ready to launch out of your slippery grasp with a single burst of power from hyper-strong hind legs. This model best represents why I coined the term "Origamido" many years ago. It was one of the first designs that demanded not only a special type of paper—color and sparkle—but folding characteristics that allowed and preserved sculptural refinement. This refinement, made possible through a special design and a special paper, embodies the Japanese suffix "do," meaning "the pursuit," "the way" or "the life." This was also around the time I had been studying Tae Kwon Do, so I was mindful of directed, long-term dedication as a way to realize a specific goal.

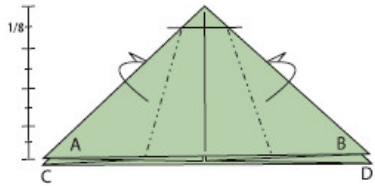
PAPER SUGGESTIONS

This origami frog should be wet-folded. Try papers that are made with cotton or abaca fiber blends. If desired, surface-finish your paper with green iridescent acrylic paints for a wet look. Colored foil-backed origami paper will work well for your first attempts; the foil can be shaped in a similar way to wet-folding. The larger standard size of this foil origami paper is 24 cm square (approximately 9≥ inches square). This is a good size to practice with.

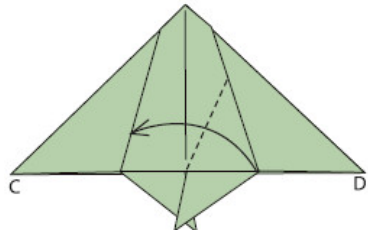
I use paper that I make specially for this model. Follow my recipe for "General Purpose Pulp" (page 123), then color the pulp to meet your desired frog's color. I use the following color recipe for my popular "Frog Paper." Using the pigment and retention agent coloring system, color the pulp a very dark green, almost black. For each pound dry weight of pulp, add 2–3 ounces (approximately 57–85 grams) by weight of iridescent green mica pigment. The paper will exhibit a totally convincing skin for your frog! Cut the paper to 8 inches square (approximately 20 cm) for a 3–4 inch frog.



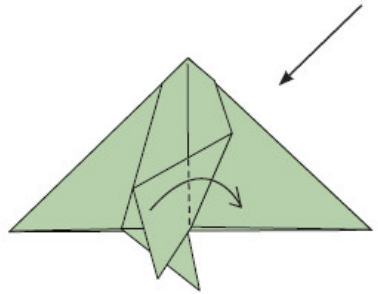
1. Valley-fold, corner to corner, both ways. Mountain-fold, edge to edge, both ways. Fold in the middle of the left and right sides as you fold the corners in half, bringing them together at the bottom.



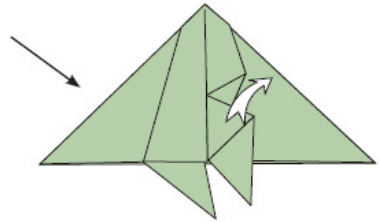
2. Mountain-fold corners A and B behind. The creases should stop at the outer edge of each side at a level one-eighth from the top. The folded edges of A and B should cross at the middle of the bottom.



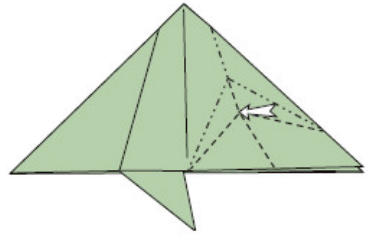
3. Valley-fold to the left, making the corner touch the folded edge while the crease hits the middle of the bottom.



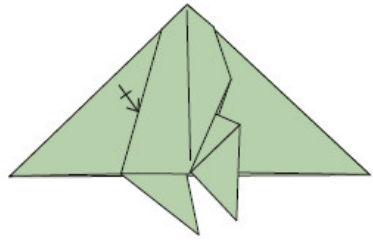
4. Valley-fold to the right. The fold should align with the center crease.



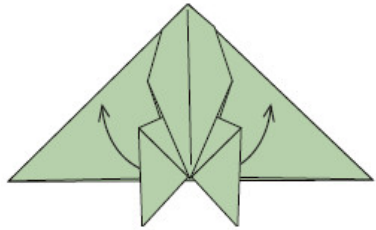
5. Unfold.



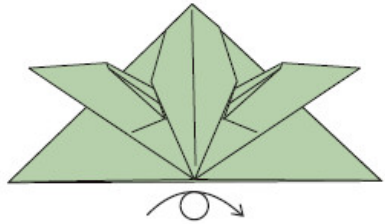
6. Use the crease pattern to mountain- and valley-fold the corner into shape. See the next step for help.



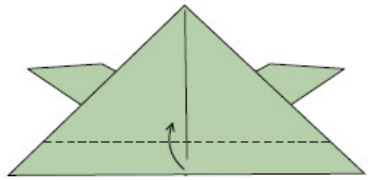
7. Repeat steps 3 through 6 on the other side.



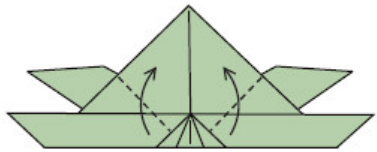
8. Fold up the bottom corner on each side.



9. Turn over, left to right.

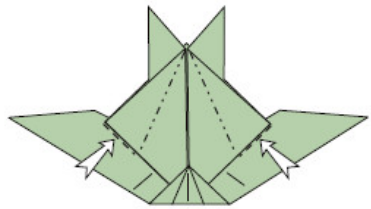


10. Fold the bottom edge up. There is no exact placement for this, but you should not fold much higher than one-fifth of the vertical span.

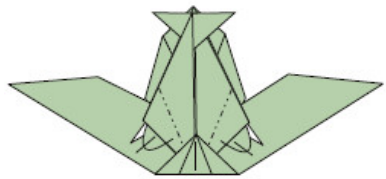


11. Valley-fold the left and right corners up so that the edges meet in the

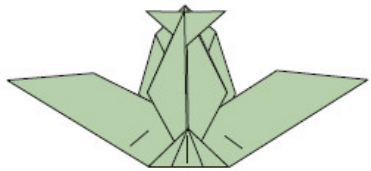
middle.



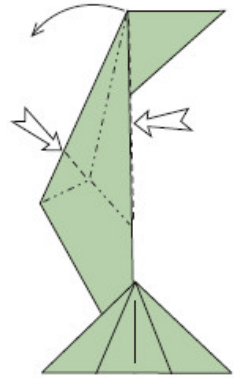
12. Inside-reverse-fold the left and right inside corners.



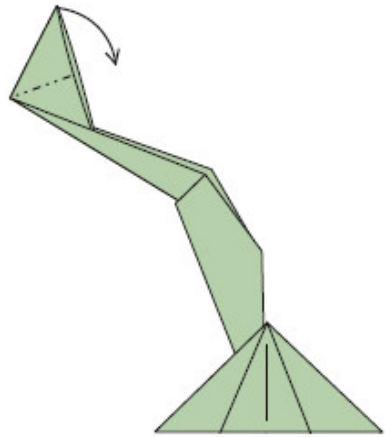
13. Mountain-fold behind.



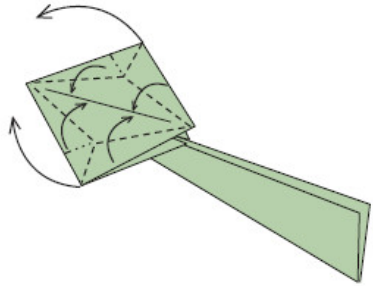
14. Your paper will look like this.



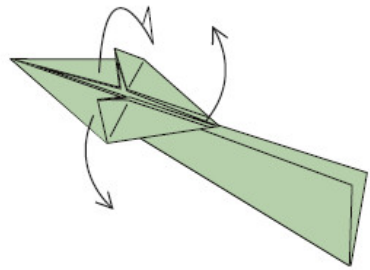
15. Forearm detail. Squeeze the left and right sides of the arm to flatten, then fold in half along the inside edge (right side of figure) while bending outward. Repeat with the other arm in the opposite direction.



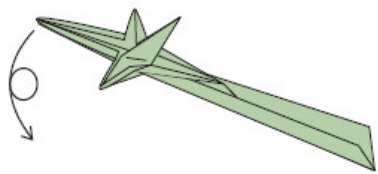
16. Squash-fold the paper for the "hand."



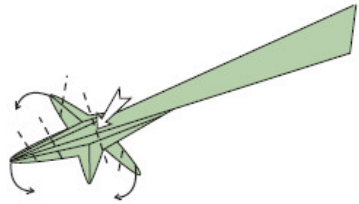
17. Fold the two square side corners in half and upward while folding all four edges to the centerline.



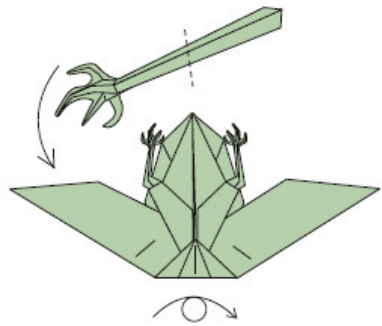
18. Fold each half down along the arm. Pull the inside point free.



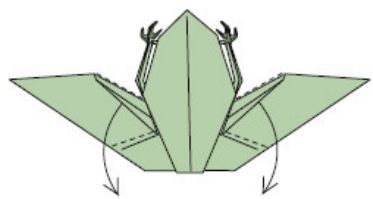
19. Turn over to shape from the other side.



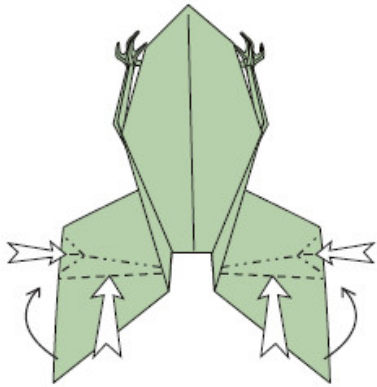
20. Bend the fingers to curve them. Dent the paper at the wrist, from the top side, and bend the “hand” up.



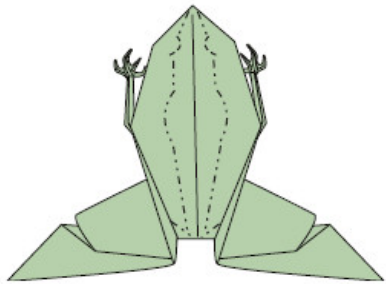
21. Bend at the elbow to move the arm inward. (See the underside view.) Return to the top side. Repeat steps 20 and 21 on the other side.



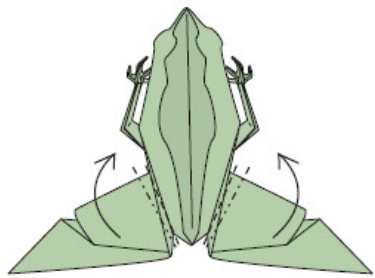
22. Inside-reverse-fold both legs down.



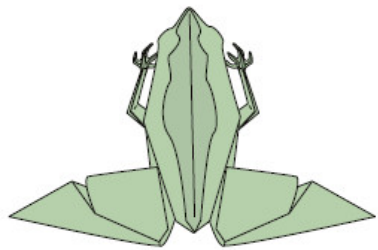
23. Mountain- and valley-fold to shape the feet and hind legs.



24. Trace graceful mountain creases along the top side of the frog to make it more three-dimensional and to form the eyes.



25. Mountain- and valley-fold the legs at their bases, near the body, to move them forward. Refine the form all over.



26. The finished Frog.

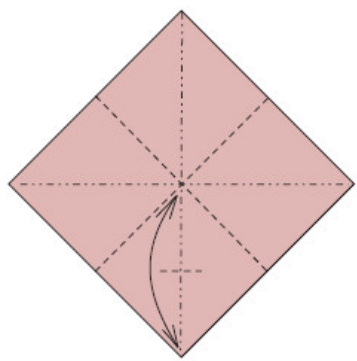
ruby-throated humming-bird

Designed by Michael G. LaFosse

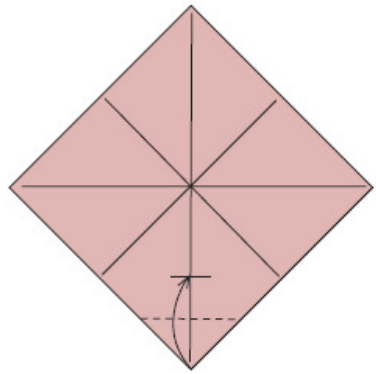
In New England, the most common hummingbird is the ruby-throated hummingbird, so I was already familiar with the species from backyard feeders. In 1997, I was fortunate to be able to live at the Arizona-Sonora Desert Museum in Tucson for an artist-in-residence program that led to my creation of a museum full of origami animals and plants of the desert. Hummingbirds are abundant in Arizona and I enjoyed this opportunity to study dozens of them up close in a walk-in aviary. The greatest challenge with this model is discovering the correct posture. We cannot see the wings of a hovering hummingbird but we can definitely see the bird's unique posture silhouetted from the side. Your origami model should capture the essence of this tiny yet powerful bird, capable of kicking into high gear in an instant.

PAPER SUGGESTIONS

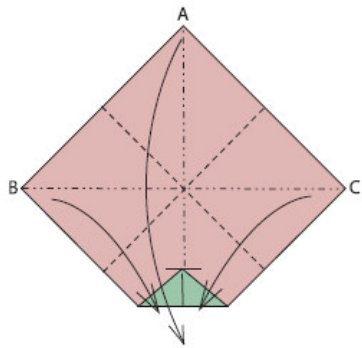
The male ruby-throated hummingbird is made from paper that is green on one side, red on the other. The female requires paper that is green on one side and white on the other, since her throat is white, not red. Now that there are so many sparkly papers commercially available, it is fun to try this model with different materials to make different species. I have developed a special handmade paper for this bird, but since bright red colored pulps are difficult to produce without using toxic pigments, we often apply a red acrylic paint to the back of the shimmering green handmade paper. We can mix the acrylic paints to adjust the color and hue while mixing in mica for shimmer, but commercially available pearlescent or iridescent acrylics are also suitable. A 6-inch (15-cm) square will produce a hummingbird 4 inches (10 cm) long.



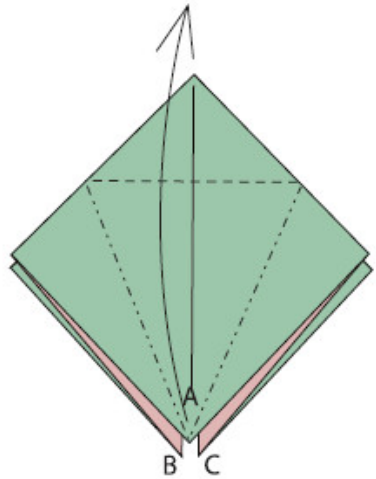
1. Begin with the red side up. Valley-fold edge to edge, both ways. Mountain-fold corner to corner, both ways. Fold the bottom corner up and make a pinch mark.



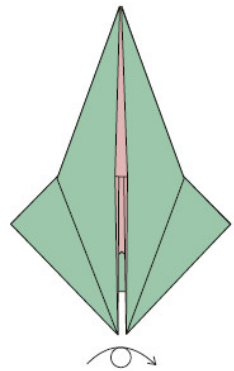
2. Fold up the bottom corner to the pinch mark.



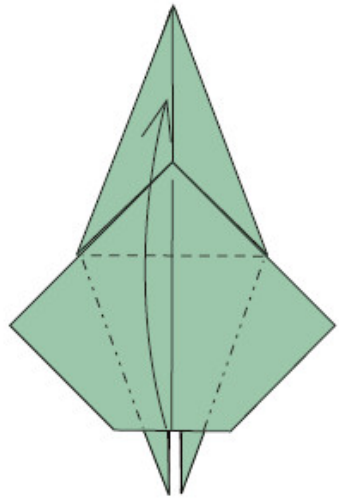
3. Use the crease pattern to bring corners A, B and C together at the bottom.



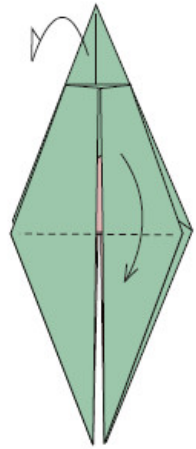
4. Petal-fold up.



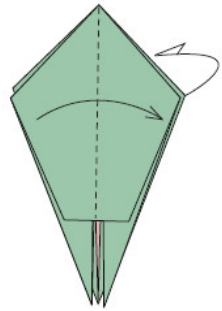
5. Turn the model over, left to right.



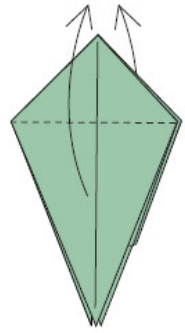
6. Petal-fold up.



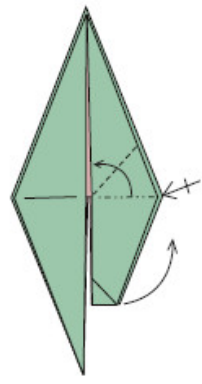
7. Bring the top flaps back down, one on each side.



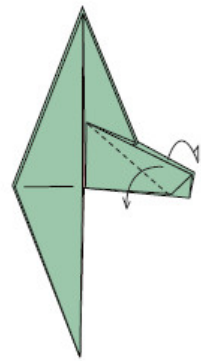
8. Reorient the paper flaps: upper-left folds over to the right; lower-right folds over to the left.



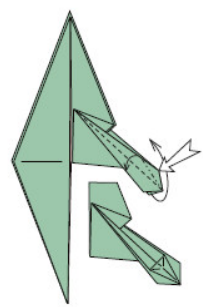
9. Bring the front and back flaps up.



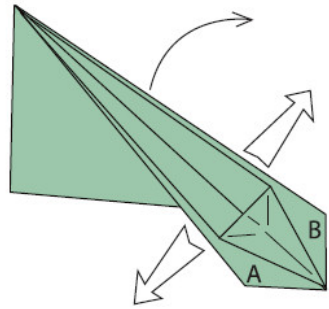
10. Mountain-fold along the middle of the right front corner of the diamond shape and move it to the center. Repeat behind. This is the tail paper.



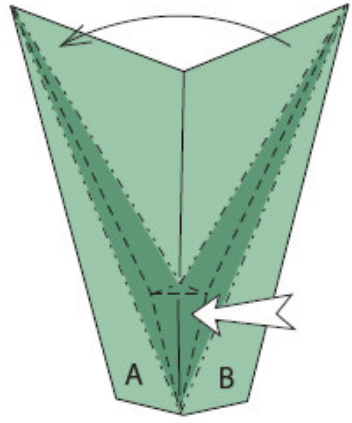
11. Fold both sides down.



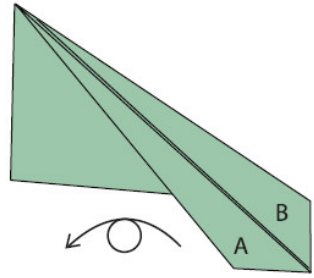
12. Open the center of the tail paper toward you and flatten it. Move the bottom back layer to make the shape symmetrical.



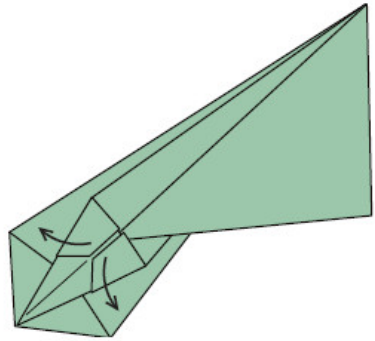
13. Pull open the tail paper.



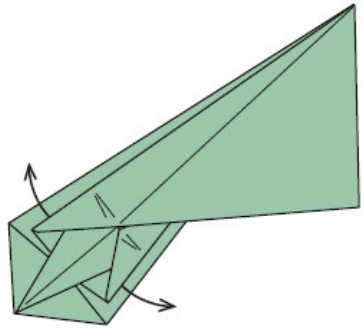
14. Sink the indicated area and close the tail paper.



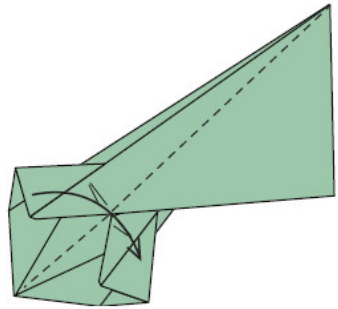
15. Turn over, right to left.



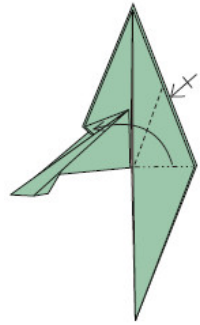
16. Open out the indicated layers.



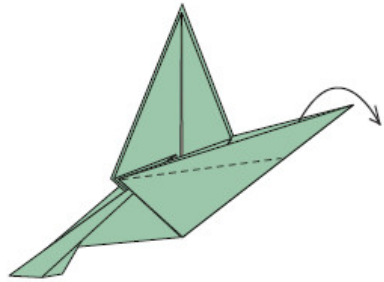
17. Pull out the center layers to inside-reverse-fold a flared section of the tail feathers.



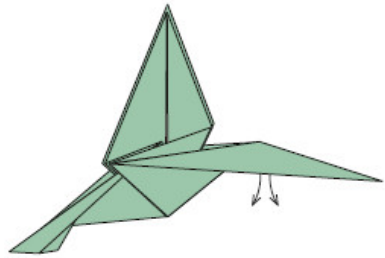
18. Fold the tail in half.



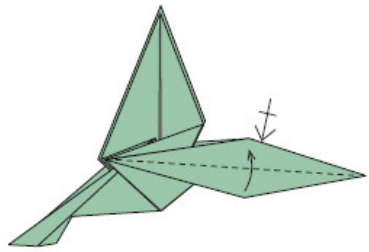
19. Mountain-fold along the middle of the right front corner of the half-diamond shape and move it to the center. Repeat behind. This is the head paper.



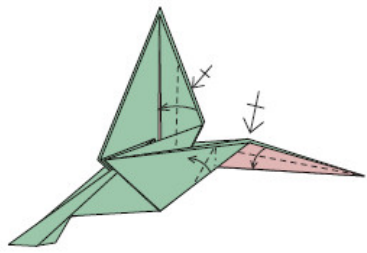
20. Outside-reverse-fold.



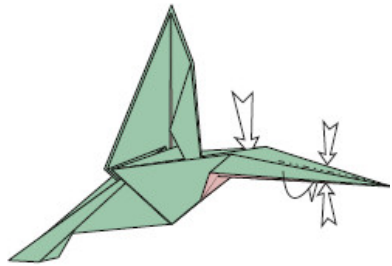
21. Bring out the layers from beneath.



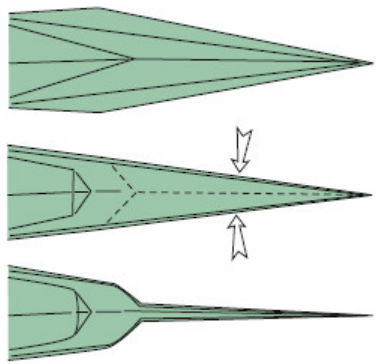
22. Fold up on each side.



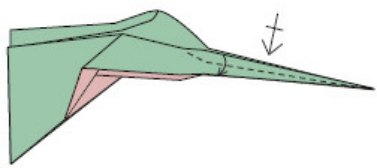
23. Swivel the red throat layer back as the top edge is brought down. Narrow each wing by folding the leading edges backward.



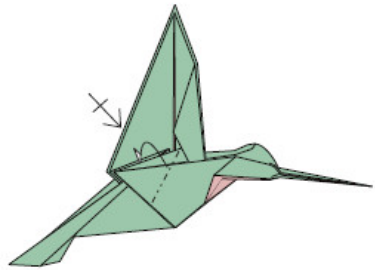
24. Sink the top front paper on the bill to narrow the point.



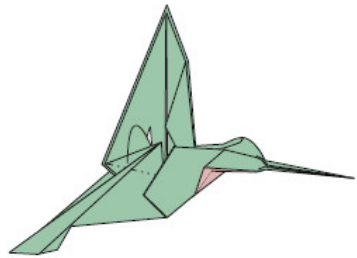
25. Top view of the bill. Compress the sides of the bill by pinching in the indicated valley folds.



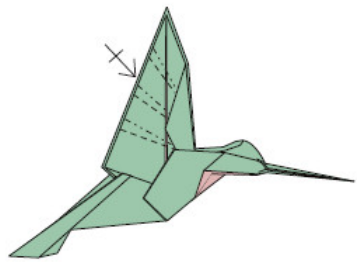
26. Fold each side of the bill down to make it slender.



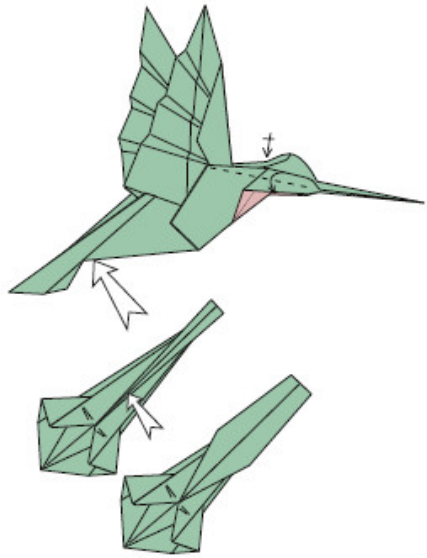
27. Mountain-fold the indicated corner behind. Repeat on the other side.



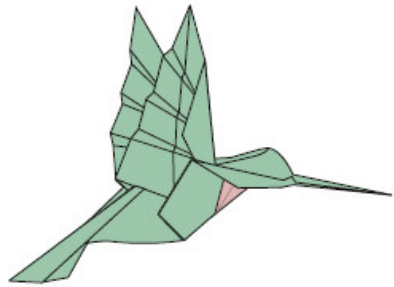
28. Mountain-fold the indicated corner down. Repeat on the other side.



29. Pleat the wings with alternating mountains and valleys.



30. Narrow the cheek by folding the outer flaps down. Pinch the back of the body, near the underside of the tail, to flatten and shape it. The body will plump up and become more graceful.

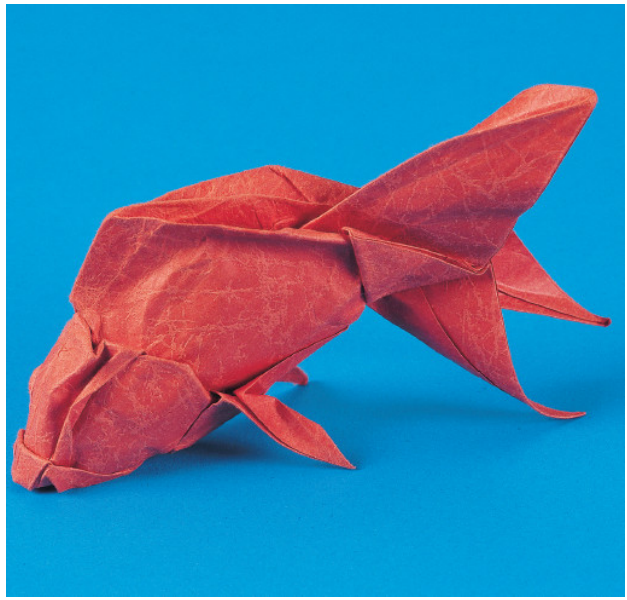


31. The finished Ruby-Throated Hummingbird.

goldfish

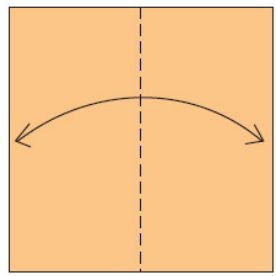
Designed by Michael G. LaFosse

This origami sculpture was created in a moment of inspired spontaneity. There were no preliminary sketches or rehearsals. Akira Yoshizawa had given me an orange piece of paper. To me, it seemed to say "goldfish," and so it became one in my hands! Sometimes a model just designs itself. I know that three hours passed when I folded this piece, but I was not mindful of the actual folding sequence. I realized afterward how focused I must have been to respond to the paper as it was being folded. If possible, spend some time observing live goldfish. Proportion, shaping, subtlety and elegance will happen at the tips of your thumb and index finger. As you finish this model, your fingers will be folding paper not unlike a charcoal artist's fluid and delicate sketching. Your origami model should exhibit your understanding of this animal's form and activity. As soon as this quality emerges, stop! Do not overwork this model.

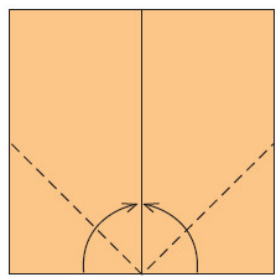


PAPER SUGGESTIONS

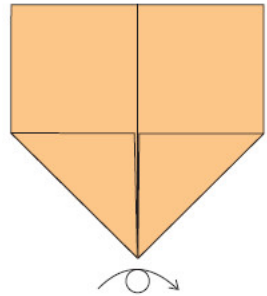
For wet-folding, use a thin paper that is heavily sized, or back-coat and surface-size an Asian-style paper. The color could be crimson, gold, silver, white or black. You may practice this model in tissue foil. A 9-inch (22.8-cm) square will produce a 5-inch (12.7-cm) fish.



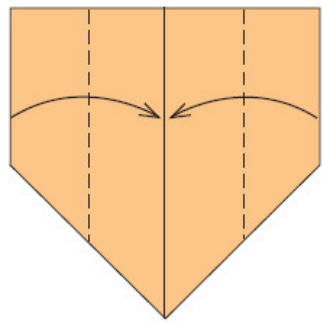
1. Fold in half, edge to edge. Unfold.



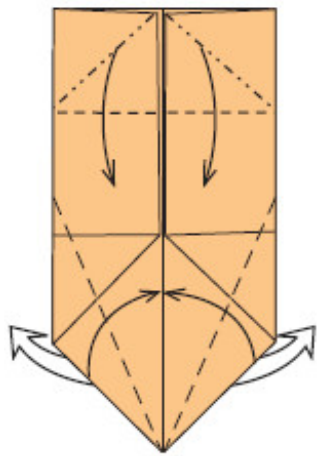
2. Fold the bottom left and right edges to the crease.



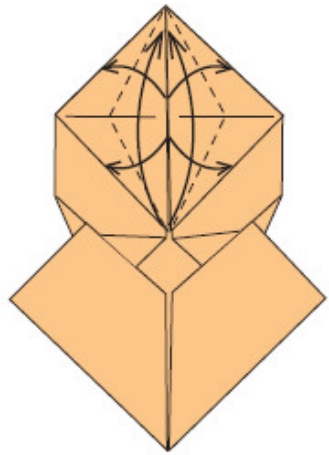
3. Turn the model over, left to right.



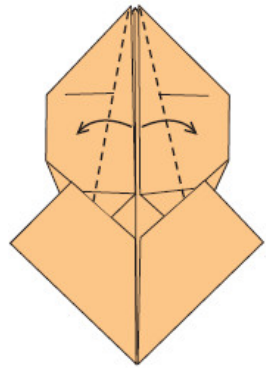
4. Fold the side edges to the center.



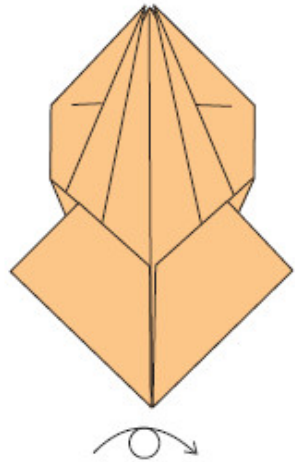
5. Mountain-fold the top corners in half and move down to the center. Fold the bottom edges to the center while allowing the corners from the back to move to the front.



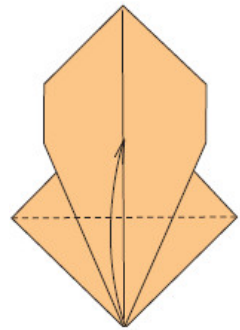
6. Pull out the centers of the upper diamond by bringing the lower points up, valley-folding inside, matching the inside edges to the outside edges.



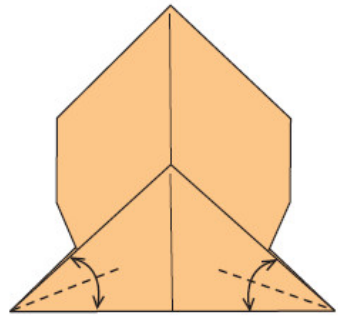
7. Fold the inner flaps outward on both sides.



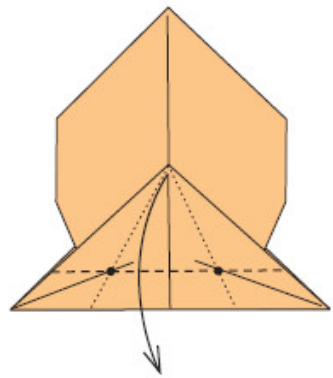
8. Turn the model over, left to right.



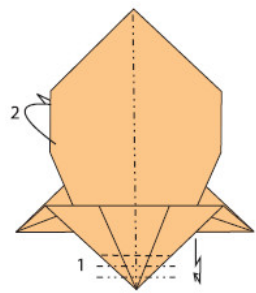
9. Fold the bottom point up, bisecting the left and right square corners.



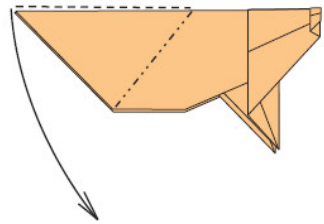
10. Pre-crease the valley bisectors on the bottom left and right corners.



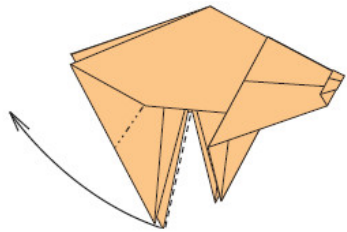
11. Fold the square corner down at the point where the pre-creases from step 10 cross the indicated X-ray view of the folded edges on the other side of the paper.



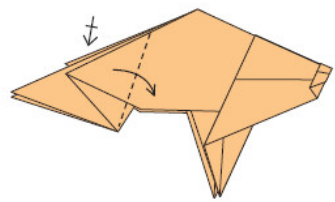
12. Mountain- and valley-fold the fish's lip and nose area. Mountain-fold in half.



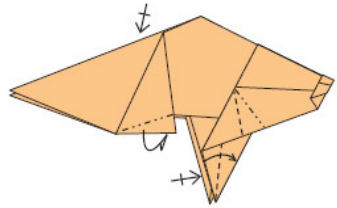
13. Inside-reverse-fold the tail straight down.



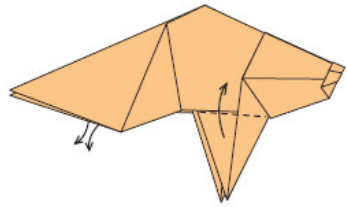
14. Inside-reverse-fold each side of the tail up, aligning the spine with the top edges.



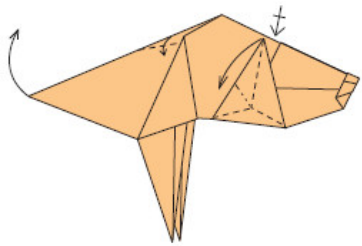
15. Fold the indicated corner forward. Repeat on the other side.



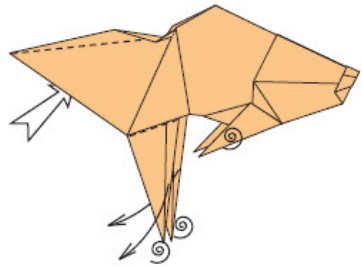
16. Mountain-fold the corner under the body. Repeat on the other side. Swivel the pectoral fin edge forward. Repeat on the other side.



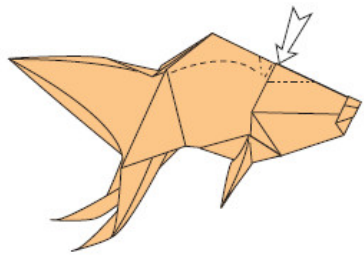
17. Fold the pectoral flap upward. Repeat on the other side. Pull the inside tail points out and down.



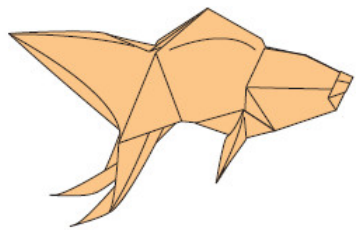
18. Fold the front fin points in half and flatten backward. Fold the top front edge of the tail fin while rotating the tail up into the body, with a crimp at the junction of the tail and body.



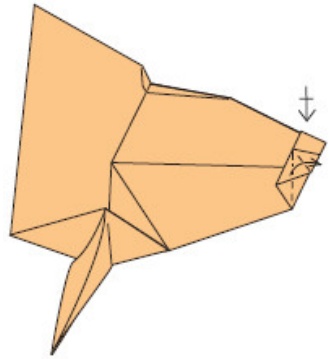
19. Fold the bottom tail points out and curl. Curl the front fins. Curl the top crease along the top of the tail, opening the tail from inside. Feel free to experiment with the shapes to make a graceful form.



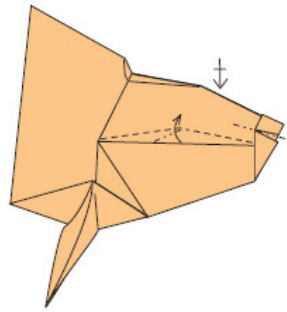
20. Round out the upper shape of the top of the back by accentuating the base of the dorsal fin with a valley pinch on either side. Crimp the dorsal fin at the junction of the base of the head.



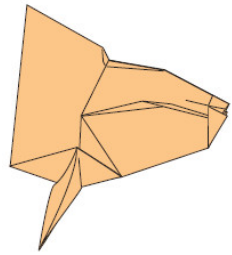
21. View of this stage.



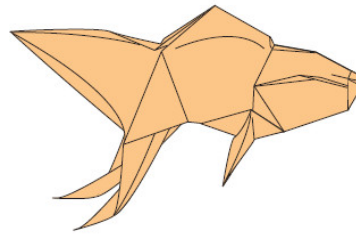
22. Narrow both sides of the lips by folding the outer edges to the lower lip.



23. Round out the snout by mountain-folding the center of the lip area. Suggest eye areas by pulling the folded edge out and upward on each side.



24. Detail of the eye area. You may add more curves to any detail.



25. The finished Goldfish.

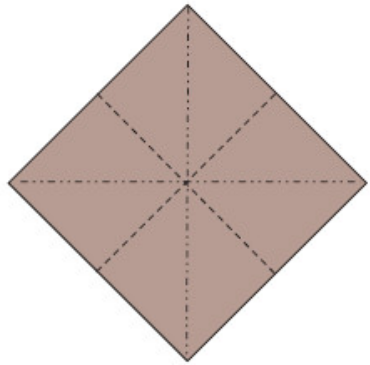
horseshoe crab

Designed by Michael G. LaFosse

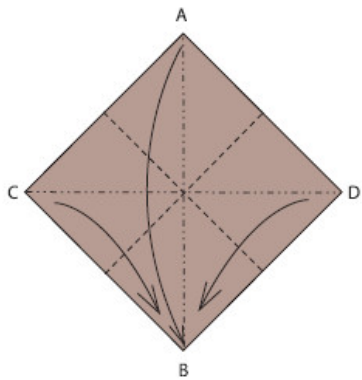
I was tempted to design a model with all of the legs, but later realized that it would require a serious compromise not worth the cost from the model's most important view—its top side. As soon as I let go of the desire to create an anatomically correct crab, it became possible to pour energy into making the top side pure, full and elegant. The subtle shaping of the front is in stark contrast to the strong, angular folds of the pointed tail and at the base of the tail.

PAPER SUGGESTIONS

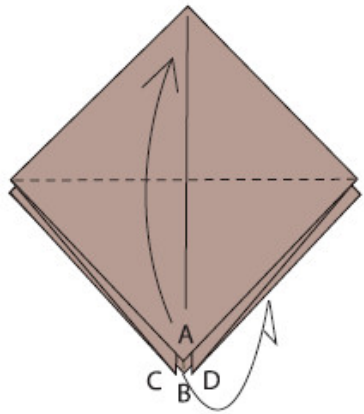
A 10-inch (25-cm) square will produce an 8∞-inch (21.6-cm) horseshoe crab. The color of the paper can be anything from beige to dark chocolate brown.



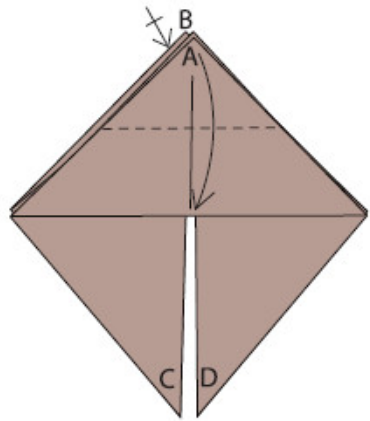
1. Mountain-fold in half, corner to corner both ways. Valley-fold in half, edge to edge both ways.



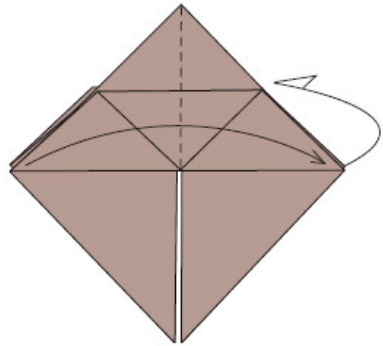
2. Use the creases to bring corners A, B, C and D together at the bottom.



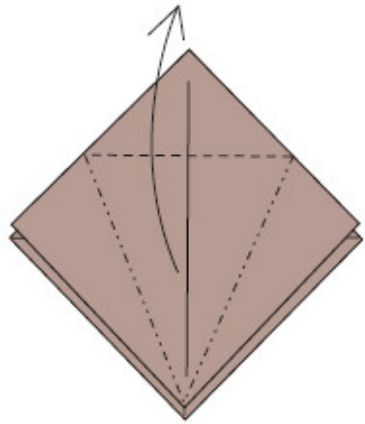
3. Fold corners A and B up to the top center point.



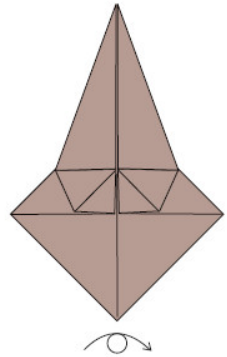
4. Fold points A and B down to the center of the paper.



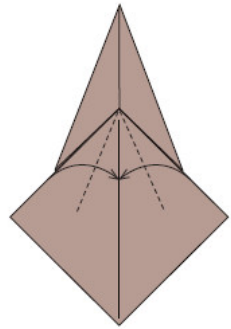
5. Fold the left top-side corner to the right and the right back-side corner to the left.



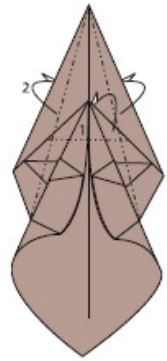
6. Petal-fold up. Do not repeat behind!



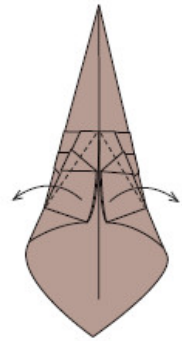
7. Turn the model over, left to right.



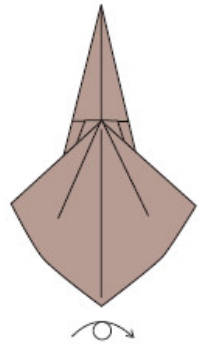
8. Fold the top edges of the square to the center crease. Do not crease the fold all the way to the edge of the paper.



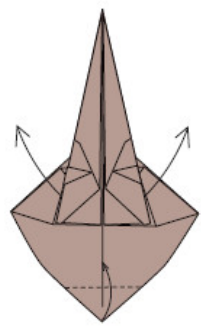
9. Mountain-fold point number 1 behind as far as it will go, flatten. Mountain-fold the outer edges of the tail (number 2) behind the model to the centerline.



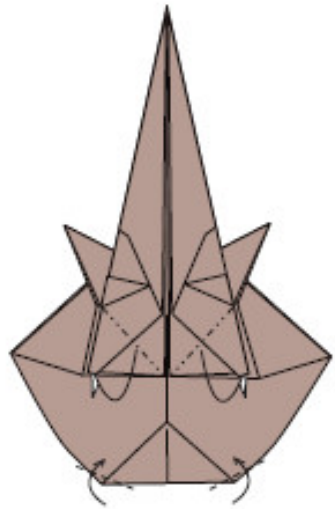
10. Fold the corners out. Do not flatten.



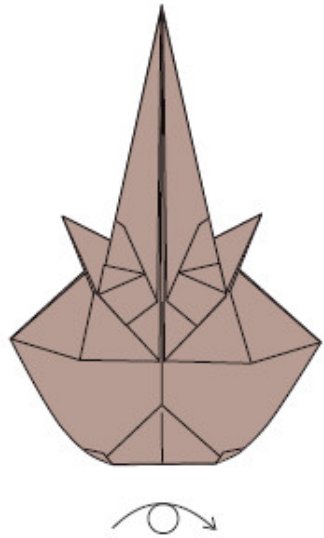
11. Turn over, left to right.



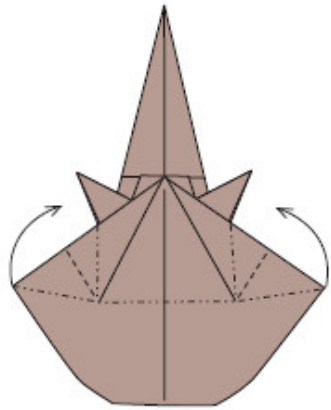
12. Fold the bottom corner up. Pull out the hidden points from each side.



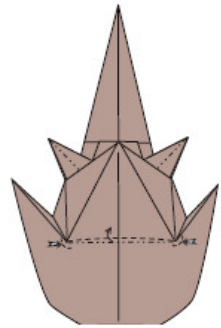
13. Mountain-fold the middle corners under. Fold small valleys at the front corners to lock the rounded shape of the shell.



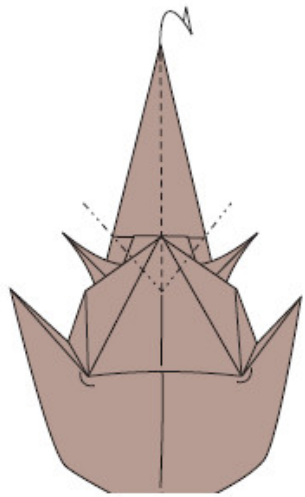
14. Turn the model over, left to right.



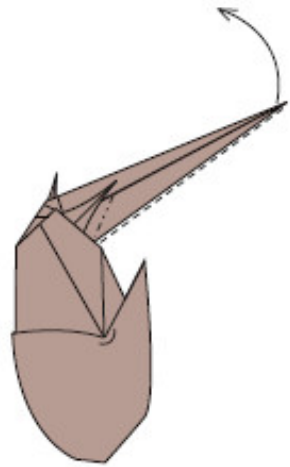
15. Mountain- and valley-fold the left and right corners to point to the rear. Form a soft mountain fold along the top of the shell.



16. Mountain- and valley-fold an edge from “eyespot” to “eyespot.” Indent the eyes, as indicated by the white arrows. Mountain-fold the left and right top corners.

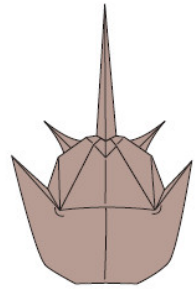


17. Inside-reverse-fold the tail down.



18. Inside-reverse-fold the tail up.

19. Narrow the tail by mountain-folding each side.



20. The finished Horseshoe Crab.

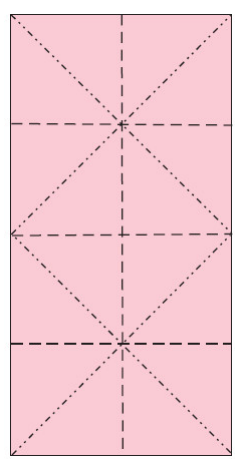
cattleya orchid

Designed by Michael G. LaFosse

To me, the orchid evokes animal-like qualities more than any other flower. Orchids display a huge variety of forms, colors and textures, and you can explore this basic model with an equally wide universe of readily available papers. Since the initial steps are folded dry, they are fairly dull and mechanical, but at the end of the process we moisten the paper and bring the model to life with delicate shaping maneuvers. Your artistic senses will take charge as you create an object of beauty, worthy of gentle care, admiration and respect.

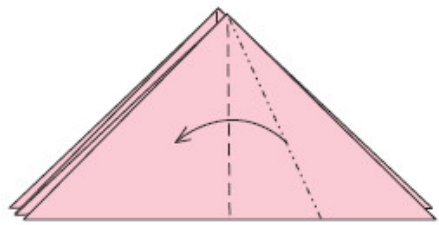
PAPER SUGGESTIONS

Begin with a rectangle of paper that is twice as wide as it is tall: 12 by 6 inches (30.5 by 15 cm) is a good minimum size. A rectangle that is 10 by 20 inches (25 by 50 inches) will produce an 8-inch (20-cm) orchid. Also, try folding this model from a duo-colored square. Begin by bringing the opposite edges to the center (this is known as a cupboard fold). The extra layers of paper will be available for you to use at the finishing steps to create contrasting colors on the petals or lip. (Also be sure to keep the split on the outside of the model as you make the initial folds.) Some of my orchids are even more lifelike because I creped the paper as I formed the sheets. This is not difficult but it does require practice. Think of crepe paper as a large, thin sheet pushed inward to make a smaller square. With uniform, nearly microscopic wrinkles, you can impart a texture that results from this additional material. When you need a little more paper, just stretch it back out! The orchid is the only model in this book that I sometimes fold with handmade crepe paper. You may use commercially available crepe papers but be aware that they are not permanent and the origami orchid will wither and fade, as a real blossom does, but perhaps over the course of a decade.

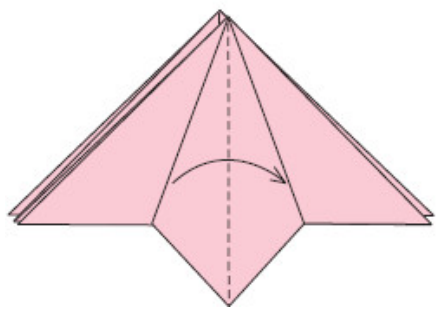


1. Valley-fold in half, long edge to long edge, and open. Valley-fold in half, short edge to short edge, and open. Valley-fold the two short edges to meet

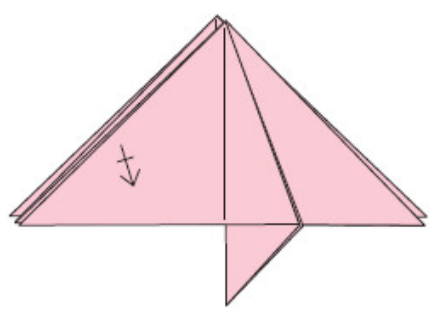
at the center and open. Mountain-fold all indicated diagonals. Use the creases to collapse the paper into the triangular shape illustrated in step 2.



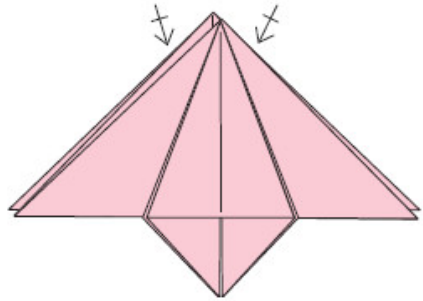
2. Squash-fold the top right side point.



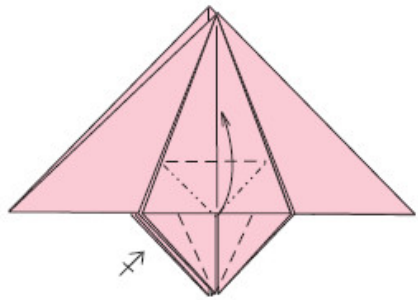
3. Valley-fold to the right.



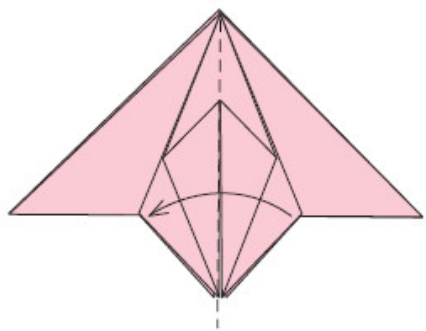
4. Repeat steps 2 and 3 on the left side.



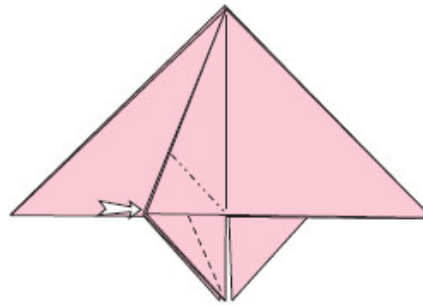
5. Repeat steps 2 through 4 on the back. You will have performed four squashes and all layers will have been arranged symmetrically.



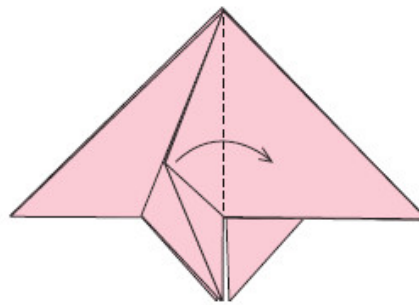
6. Mountain-fold the middle of the indicated free edge up while valley-folding the lower free edges to align with their centered folded edges. This is a petal fold. Repeat behind.



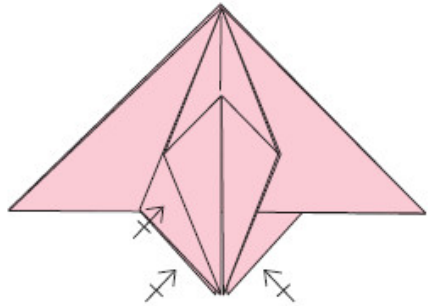
7. Fold both layers of the right half of the kite shape to the left.



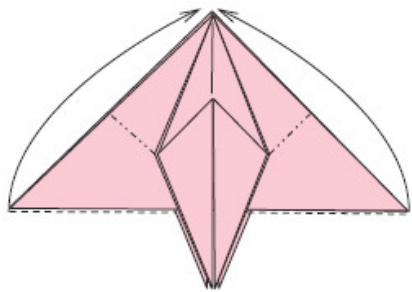
8. Inside-reverse-fold.



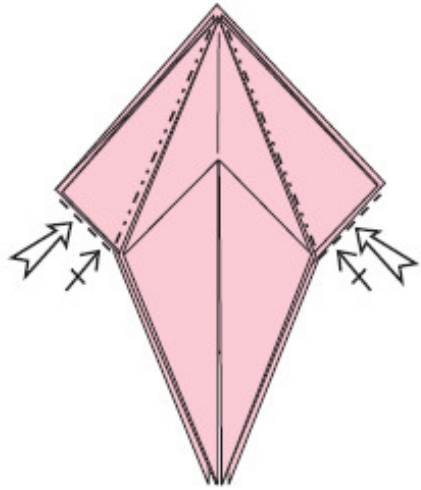
9. Fold the two top layers to the right.



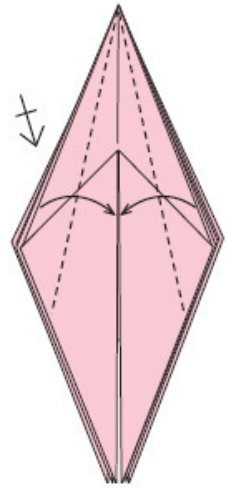
10. Repeat steps 7 through 9 on the front left side and to both sides at the back.



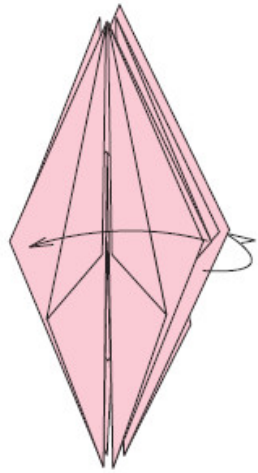
11. Inside-reverse-fold the large middle corners up.



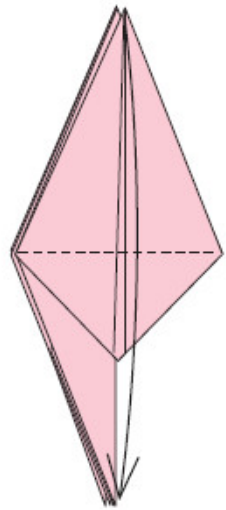
12. Inside-reverse-fold these four square corners.



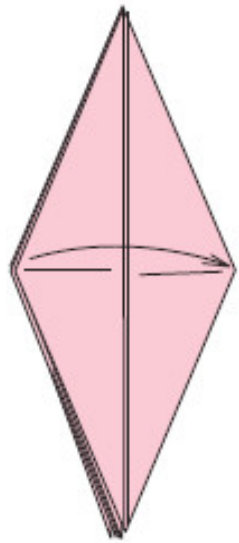
13. Fold in the top edges of the first layer to meet close to the center. Leave a little space. Repeat on the back.



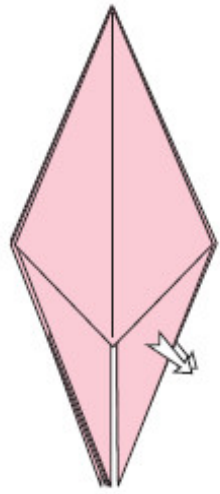
14. Fold the first three front layers to the left. Repeat with two layers on the back.



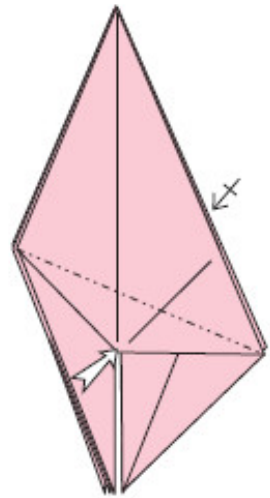
15. All full-length layers should now be on the left. Fold down the top point.



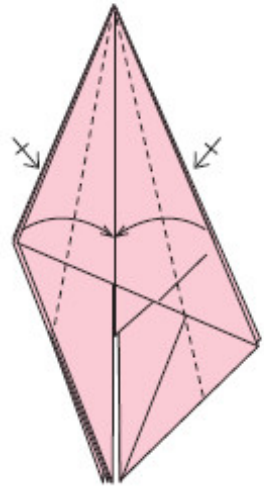
16. Fold the top layer to the right.



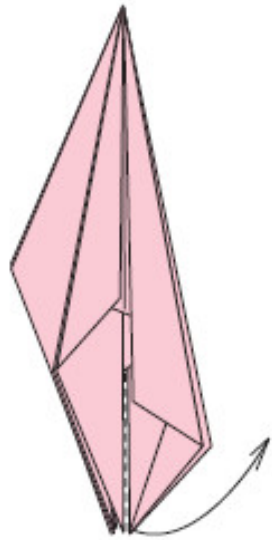
17. Free the indicated layers by pulling them out, front and back.



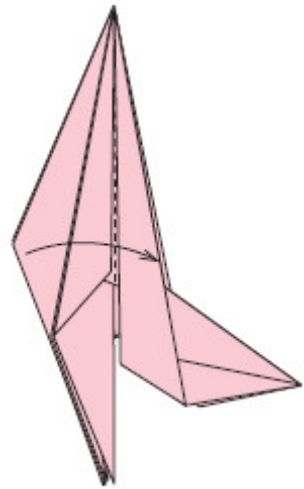
18. Mountain-fold the layer in. Repeat behind.



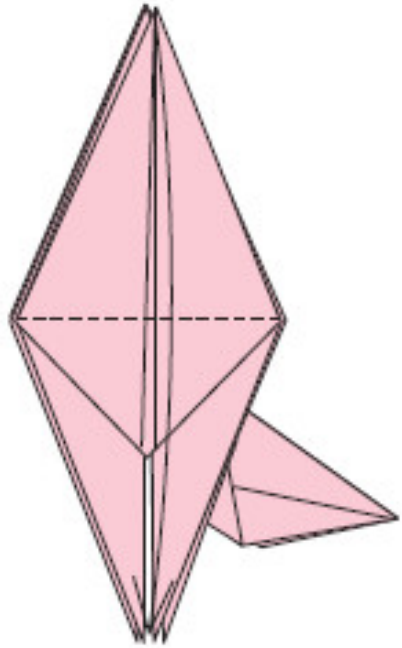
19. Fold the top edges in, close to the center but not all the way. Repeat behind.



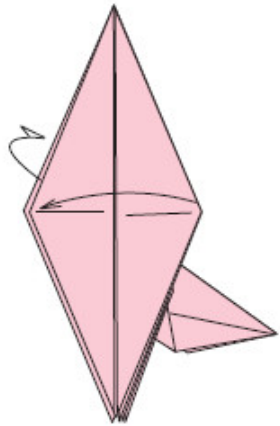
20. Inside-reverse-fold.



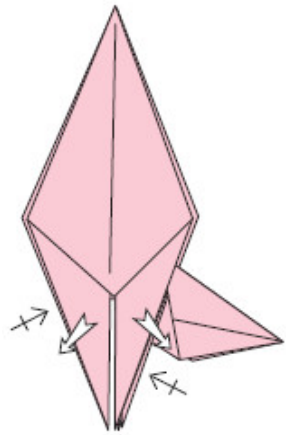
21. Fold to the right.



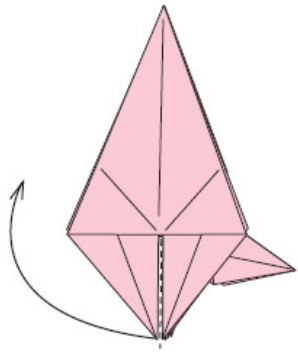
22. Fold the top point down.



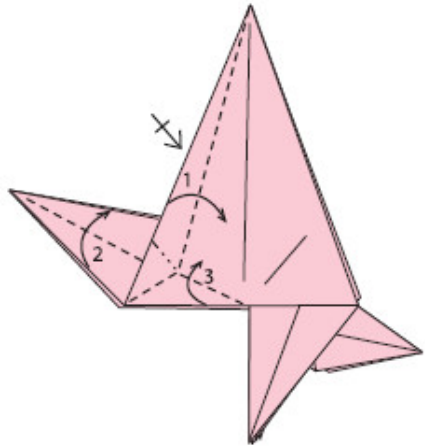
23. Fold the back left layer behind and to the right. Fold the top layer to the left.



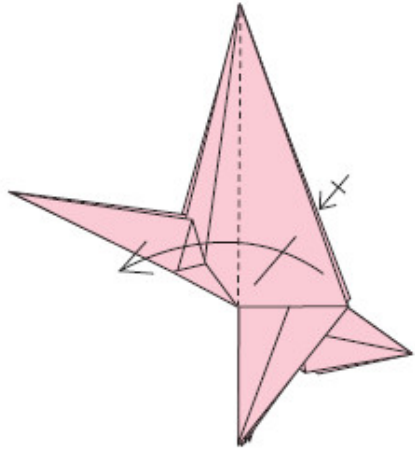
24. You should have two layers on the left. Free the indicated layers by pulling them out, two in the front and two in the back.



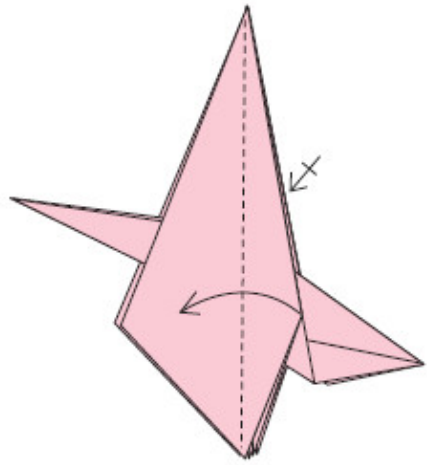
25. Inside-reverse-fold.



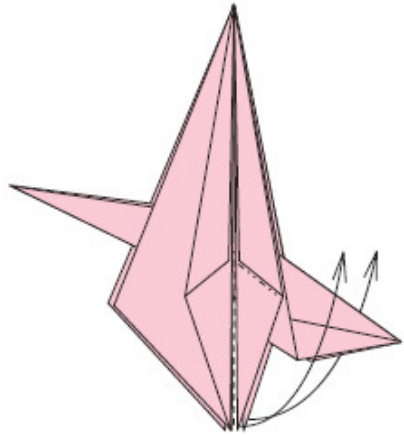
26. Fold in edge number 1, about one-third. Fold up edge number 2, then fold up number 3. Repeat behind.



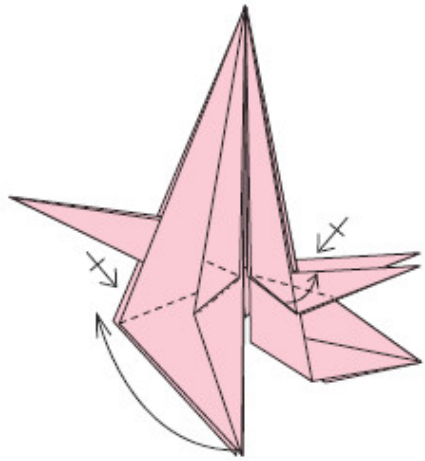
27. Fold the top right layer to the left. Repeat behind.



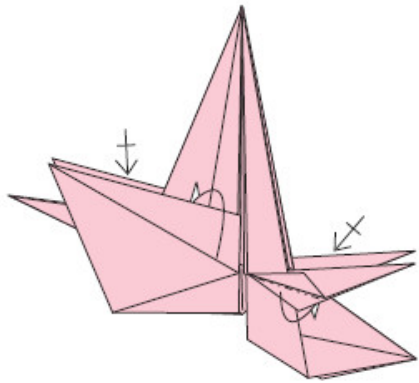
28. Fold the next layer to the left. Repeat behind.



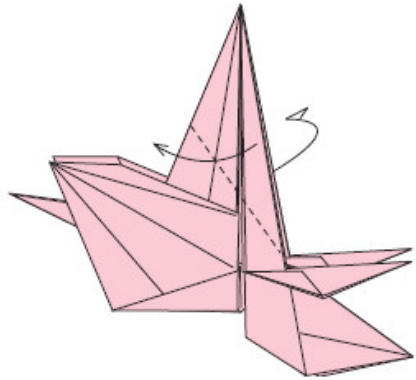
29. Inside-reverse-fold the bottom right points.



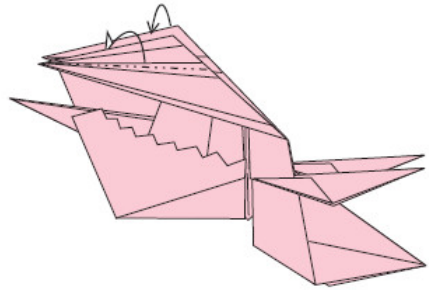
30. Fold the indicated edge of the right point up. Repeat behind. Inside-reverse-fold the bottom left points.



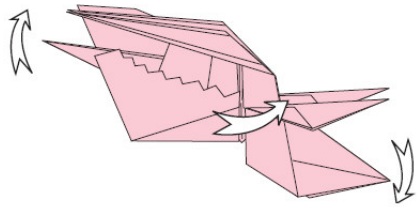
31. Mountain-fold the indicated edge of the right point behind. Repeat behind. Turn the indicated edge of the left point inside out. Repeat behind.



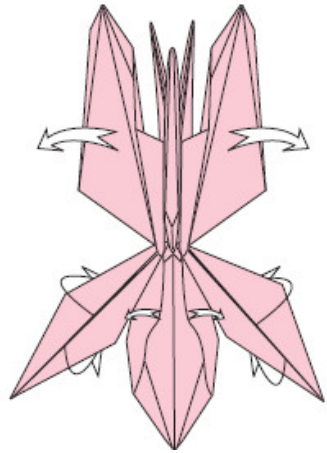
32. Valley-fold the top point to the left. Repeat behind.



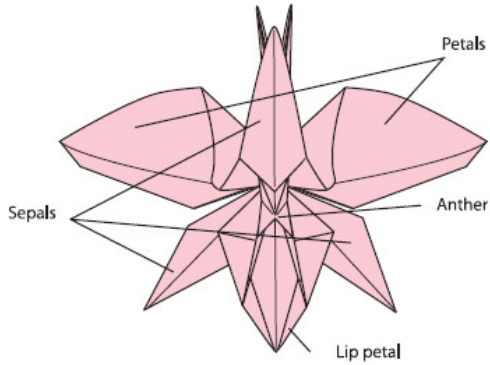
33. Mountain-fold to make the points narrower.



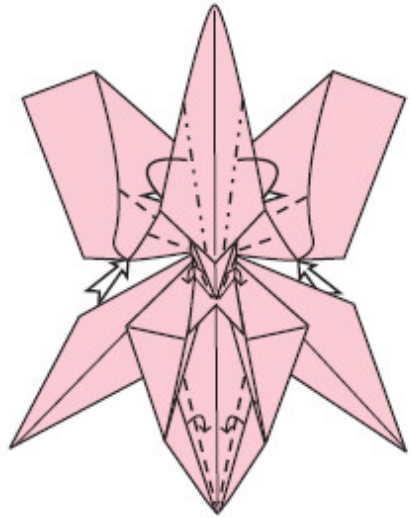
34. Rotate the model to view from the front. Open slightly.



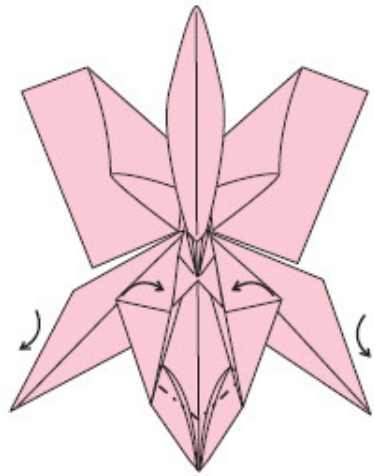
35. Front view. Spread open the upper petals. If desired, turn the top layers of the lower left and lower right petals inside out. Spread open the bottom center petal.



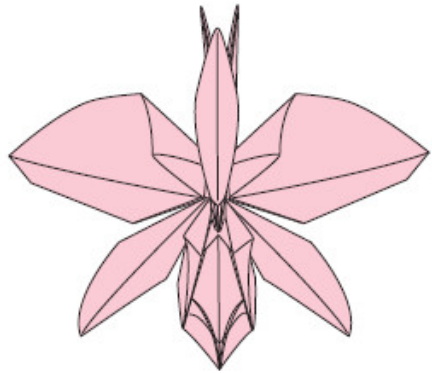
36. This is one of my favorite orchid bases from a 2:1 rectangle, shown opened. Be creative and discover many new "species" of origami orchids from this base. Different papers allow a variety of shaping potential. The following diagrams will lead you through dry-folding one possible shape. Wet-folding or crepe paper instructions continue at step 44.



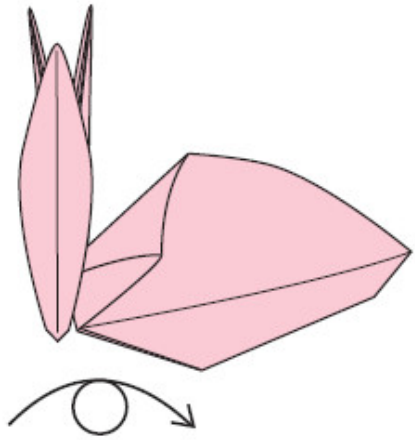
37. Mountain-fold the outer edges of the top sepal while inside-reverse-folding the paper between this and the upper petals. Fold over the top edges of the anther. Fold in the indicated edges within the lip petal.



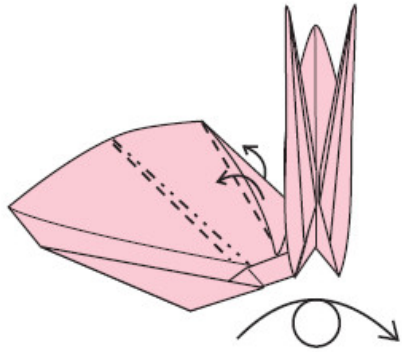
38. Curve the lip petal and lower sepals into a pleasing shape. Feel free to experiment! Mountain-fold down the point of the lip petal.



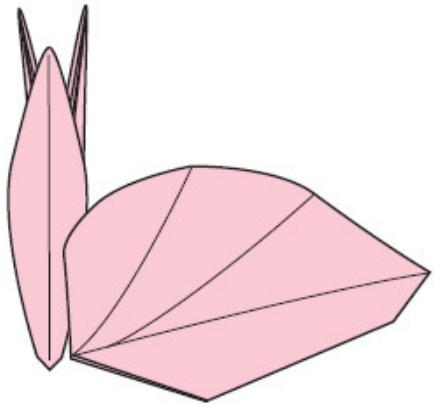
39. Full view.



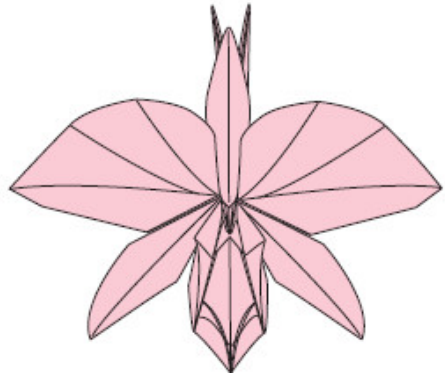
40. Turn over, left to right.



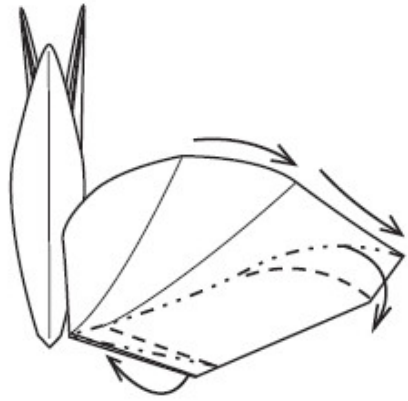
41. Mountain- and valley-fold a pleat at the middle of the back of the upper petals. Valley-fold the inner leading edge to the back side. Turn over, left to right.



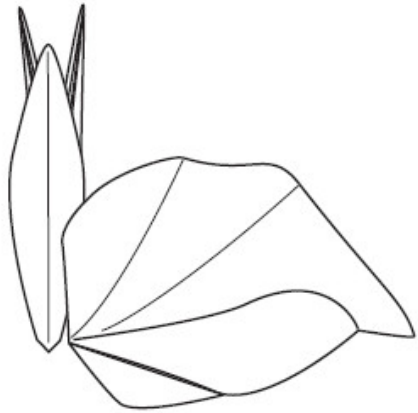
42. Front view of shaped petal. Again, experiment.



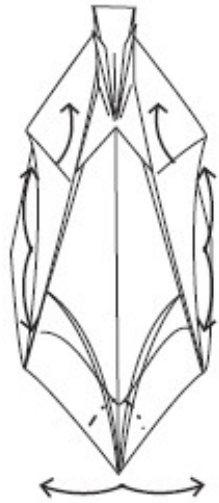
43. The finished Orchid, dry-folded.



44. When using crepe paper or when wet-folding this orchid, additional shaping is possible. Spectacular lifelike renditions can be made in this way. Crepe paper can be stretched and curled to the extreme. Here, the centerline of the upper side petal is mountain-folded while being stretched in a curved path. This curved mountain edge is then valley-folded downward. The back layer of the bottom edge is brought back to the front and rounded by stretching it.

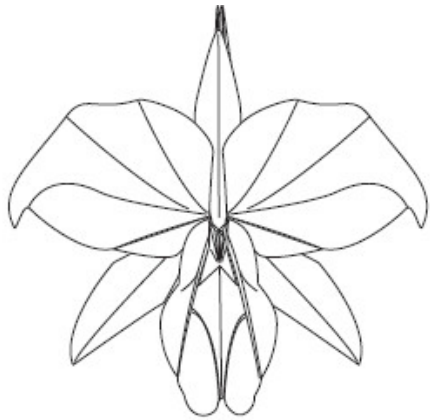


45. The completed shape.



46. The lip petal can be made more shapely by stretching and curling any of its free edges. Stretch and inside-reverse-fold the front end.

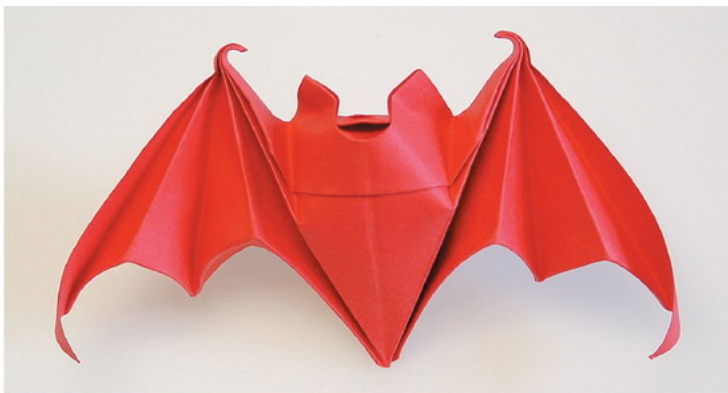
47. The completed shape. Many forms are possible.



48. The finished Cattleya Orchid.

happy good-luck bat

Designed by Michael G. LaFosse

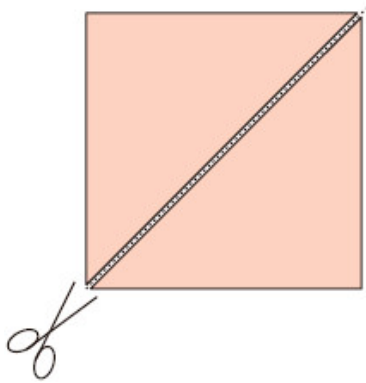


The bat is a splendid creature. Some pollinate our fruit trees and others pollinate important crops. They produce copious amounts of fertilizer. They keep insect populations in check. They provided the clues to discover sonar and radar. And they are cute! Many mammals only dream of flying. Bats actually get the job done. This highly stylized bat was inspired by traditional Chinese decorative arts in which similar simplified shapes grace pottery, textiles, paintings and carvings. The Chinese words for bat and good fortune both sound alike (fu). *In China, five red bats are a traditional good luck symbol: five is a lucky number, red is a lucky color and the bat is a symbol*

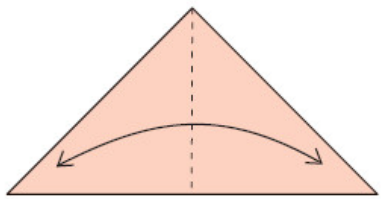
of good fortune. With only a few folds, this bat makes an excellent beginner's wet-folding project. Leave the wings closed to make roosting bats, and then display some of them upside down, huddled in the top corner of a shadow box frame.

PAPER SUGGESTIONS

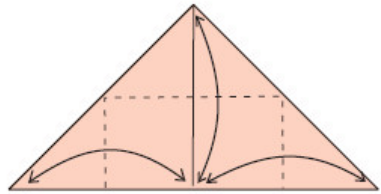
Use a heavier, stiffer paper. It should feel as supple as glove leather when moistened. For economy's sake, cut the square along the diagonal and begin with a triangle. A 6-inch (15-cm) square will produce two Happy Good-Luck Bats with 5-inch (12.7-cm) wing-spans. This model may be dry-folded from tissue foil.



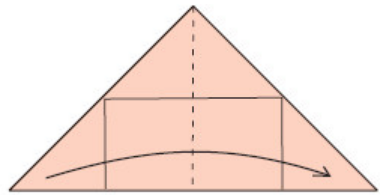
1. For the wet-folding method, cut a square of heavy art paper diagonally in half. Use each half for one bat. For the dry-folding method, fold a thin square of origami paper or foil diagonally in half. Either way, the starting shape is an isosceles right triangle.



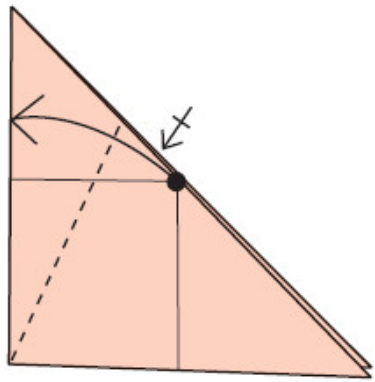
2. Fold in half, corner to corner, and unfold.



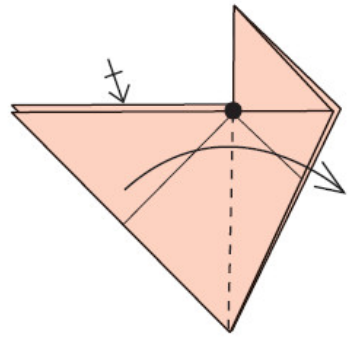
3. Fold each corner to the middle of the bottom edge. Unfold all.



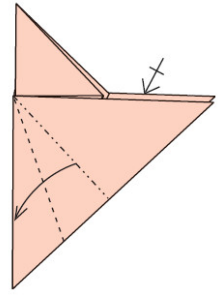
4. Fold in half.



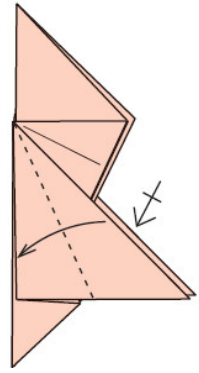
5. Place the point of the intersecting creases, indicated with a dot, on the folded edge, ensuring that the fold intersects the square corner. Repeat behind.



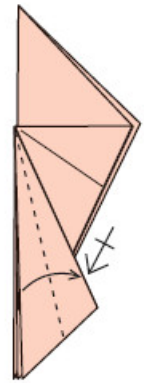
6. Fold to the right. Repeat behind.



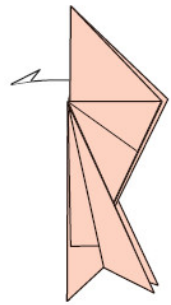
7. Move the mountain crease to the folded edge. Repeat behind.



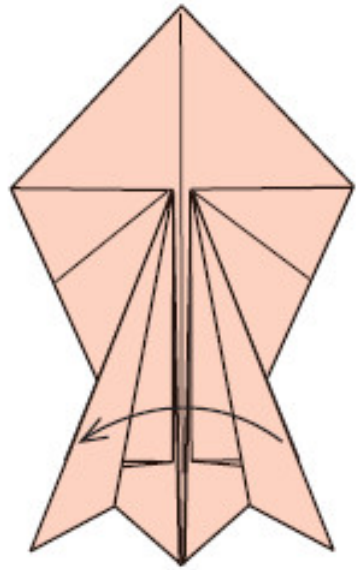
8. Fold the free edge to the folded edge. Repeat behind.



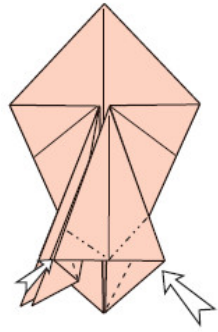
9. Fold the free edge to the folded edge. Repeat behind.



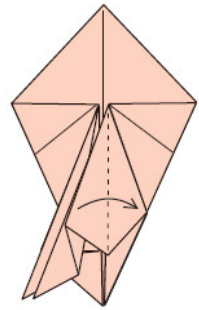
10. Open by moving the back layer to the front.



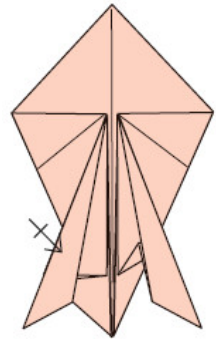
11. Move the right layers to the left. Look ahead at step 12 to see which layer is topmost.



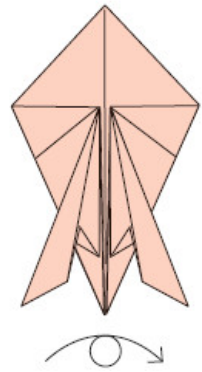
12. Inside-reverse-fold the left and right bottom edges.



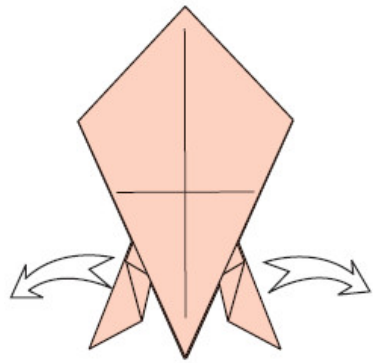
13. Replace layers to the right.



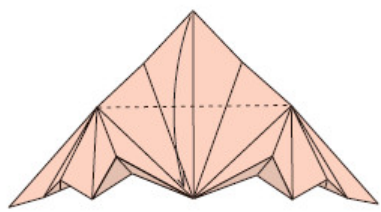
14. Repeat steps 11 through 13 on the left.



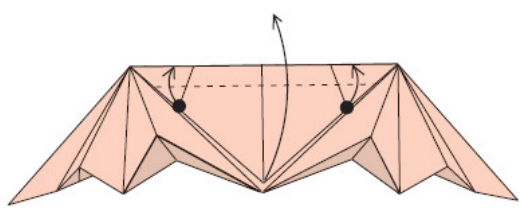
15. Turn over, left to right.



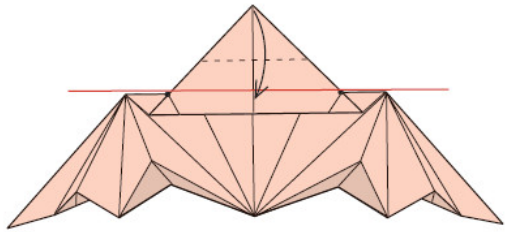
16. Pull the wings open.



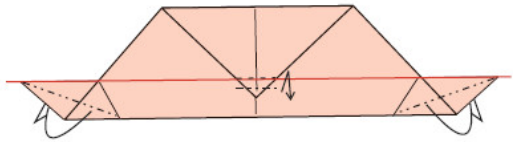
17. Fold down the top corner to touch the bottom center.



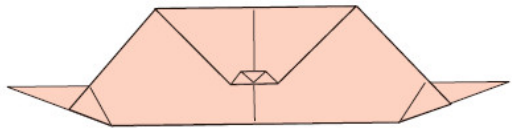
18. Fold the corner up. The correct amount can be judged by placing the ends of the indicated creases (black dots) on the top folded edge.



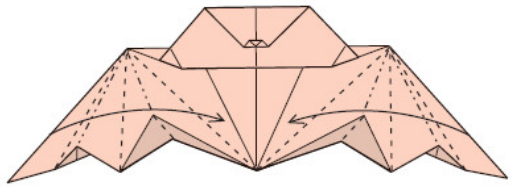
19. Fold the top corner down so the corner is below the level of the red line but not touching the folded edge.



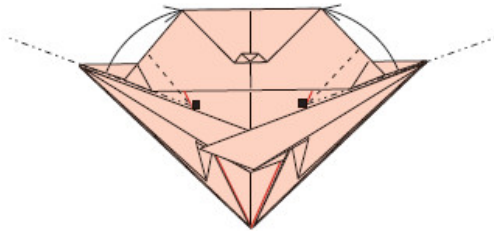
20. Fold the corner up to the level of the red line. Fold the corner down to touch the middle of the folded edge below. Mountain-fold the indicated edges under as far as possible.



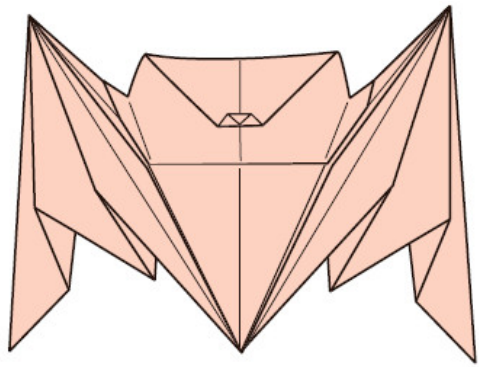
21. The top of your paper should look like this.



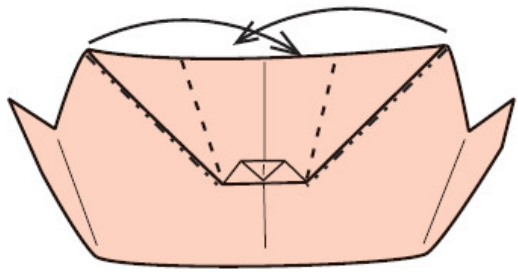
22. Use the pleats in the wings to close and flatten the model.



23. Mountain-fold along the edges of the wings from their outward corners down to the creases on the body indicated by the black squares. Move these mountain-folded edges of the wings up to the top corners of the head, valley-folding between to make the body plump.

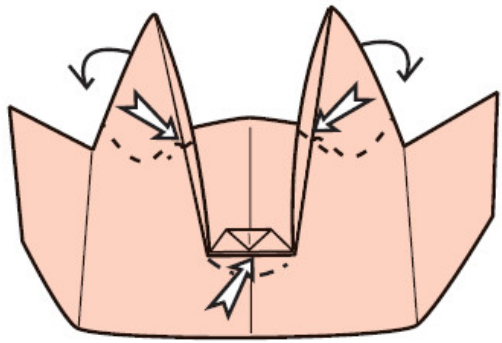


24. Open the wings slightly.

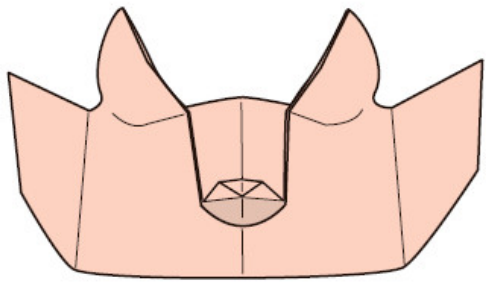


25. Mountain-fold along the cut edges of the top layer of paper on the head, stopping at the mouth corners. Fold the top corners of the head over each

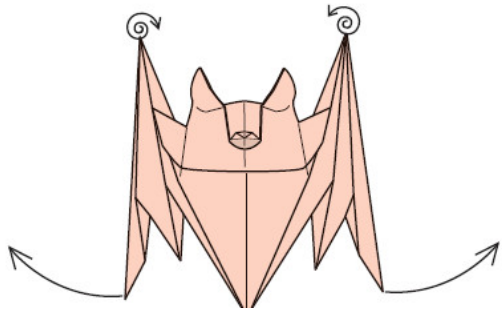
other and raise them straight up for the ears.



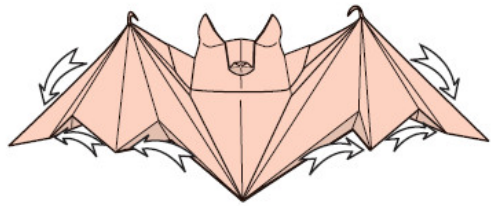
26. Twist the ears to face forward. Open the mouth (you may use the point of a skewer or pen to do this). Be creative and try for expression with these folds.



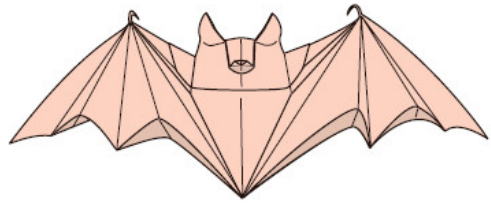
27. Detail of the head.



28. Open the wings wide. Curl the thumbs inward.



29. Make graceful curves in the outer edges and the scalloped underline of the wings.



30. The finished Happy Good-Luck Bat.

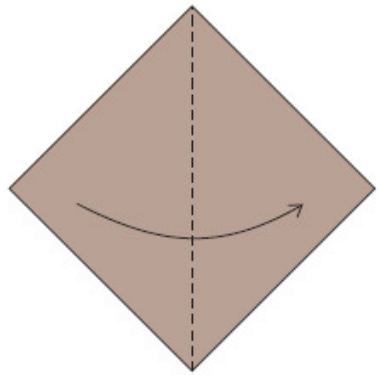
big brown bat

Designed by Michael G. LaFosse

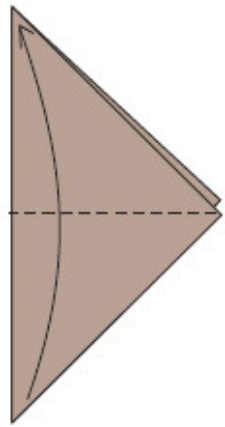
I was fortunate to work with these bats while in college working toward a degree in biology, which gave me an opportunity to study their form, postures and behaviors. Even so, it took scores of hours of origami experimentation to approximate the form and proportions of this bat, Eptesicus fuscus. *More than any other origami work, this one reminds me of what master Yoshizawa said, "Remember that the paper is the flesh, and the folds are the bones."*

PAPER SUGGESTIONS

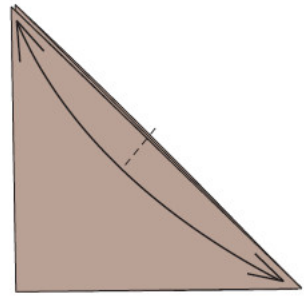
Use a 10-inch (25-cm) square for a life-size model, with a wingspan of about 10 inches. The paper should be highly sized: thin, crisp and hard. Papers made from flax, abaca or hemp fibers are my favorites, but several Asian papers are suitable after back-coating.



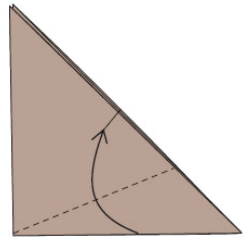
1. Fold in half diagonally.



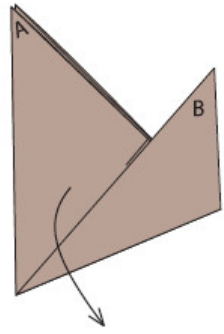
2. Fold in half again.



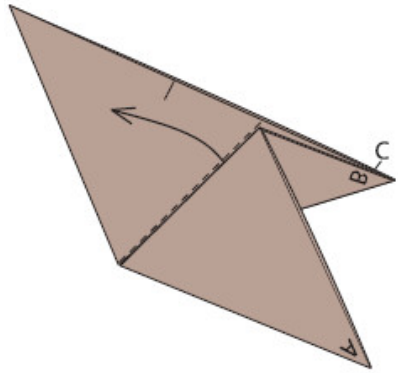
3. Mark the center of the longest side of the triangle with a pinch.



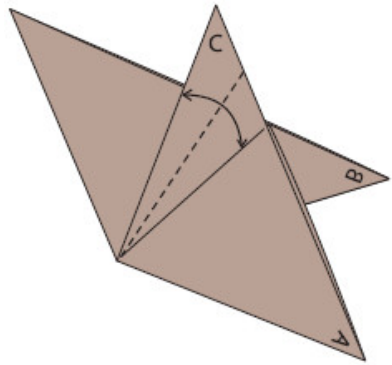
4. Fold the lower edge to the intersect mark and the right-angled corner.



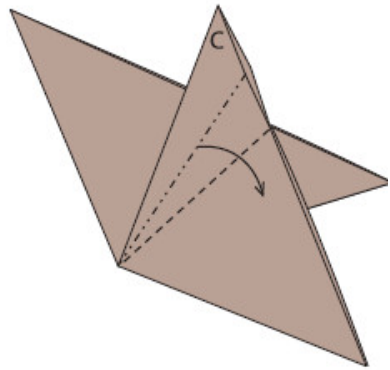
5. Open the top points, bringing front flap A and lower point B down.



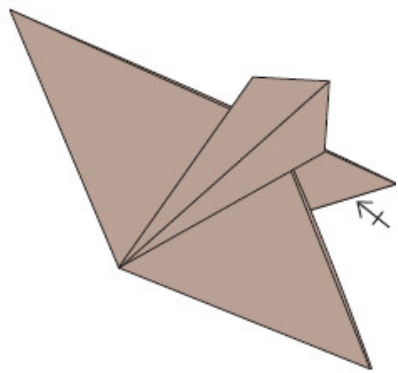
6. Separate points B and C, bringing C out to the left at the arrow.



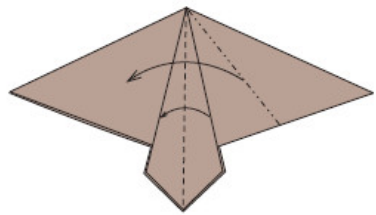
7. Bisect the angle with a valley fold to pre-crease flap C .



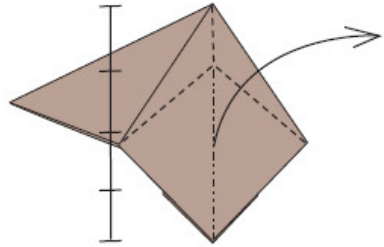
8. Squash C.



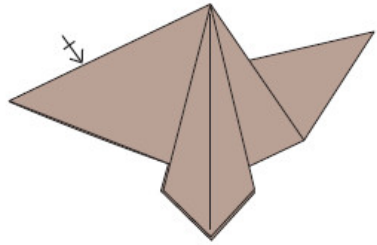
9. Repeat steps 7 and 8 on the other side.



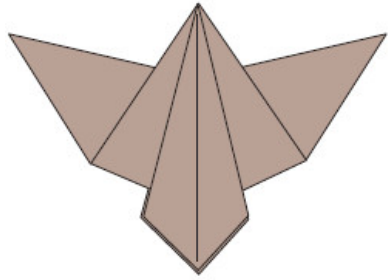
10. Fold the center flap to the left. Squash-fold the right flap.



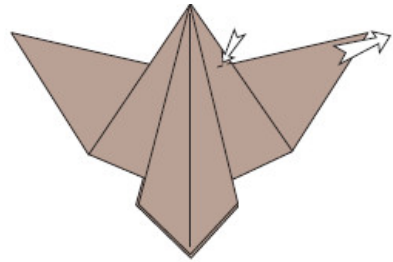
11. Mountain- and valley-fold the point out, terminating the origin of the radial valley at half the distance from the top of the model.



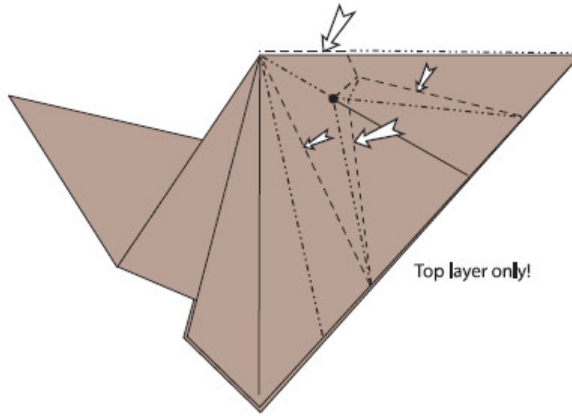
12. Repeat steps 10 and 11 on the other side.



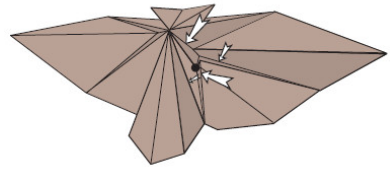
13. Top view at this stage. Move the center flap back to the right.



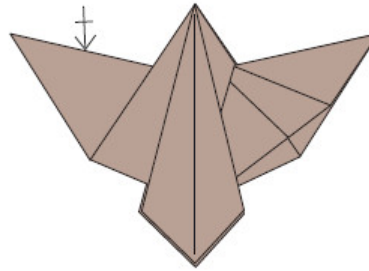
14. Pinch at the junction of the head and shoulder. Pull out the right wing.



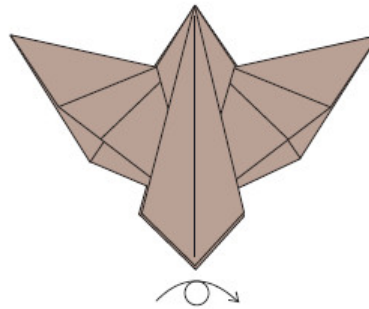
15. Pre-crease the top layer only to create the upper wing surface. The black dot represents the pinch mark made in step 14.



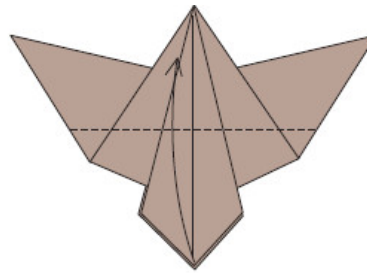
16. Pinch and tuck as indicated to shape the upper wing.



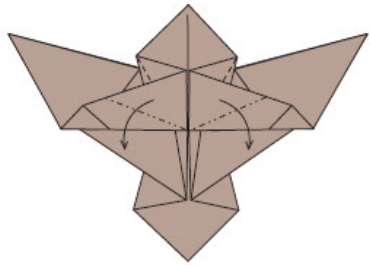
17. Repeat folding on the other wing in the same way.



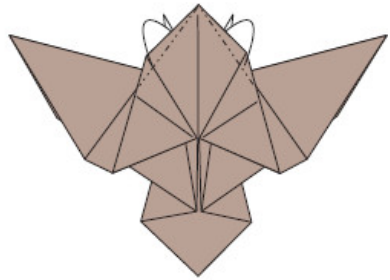
18. Your paper should look like this. Turn over, left to right.



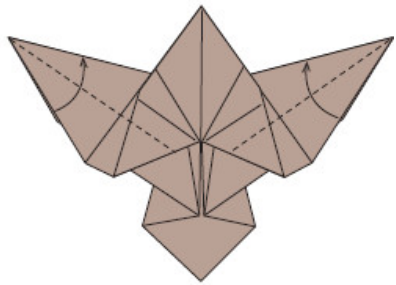
19. Fold the bottom corner to the top.



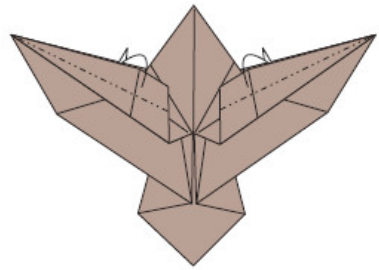
20. Bring the inner layers back down, pulling layers out as shown.



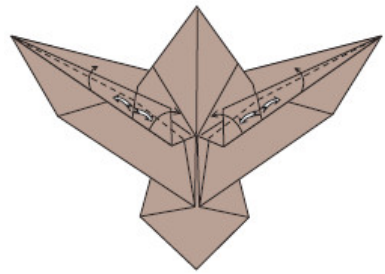
21. Narrow the top, matching the profile of the back corner.



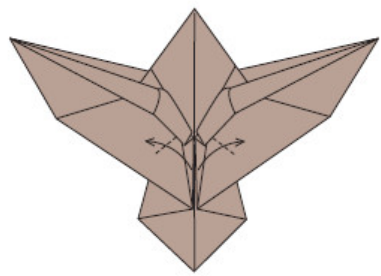
22. Fold the bottom edge to the top, upper layer of each wing.



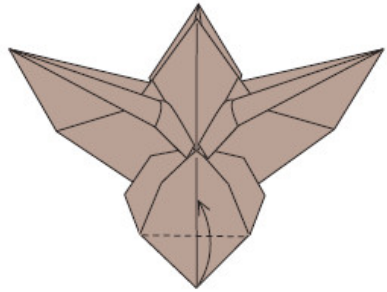
23. Mountain-fold the leading edges behind.



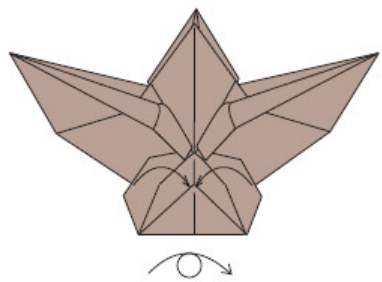
24. Form the “bones” of the arms by valley-folding as shown. Pull to stretch where indicated by the white arrows.



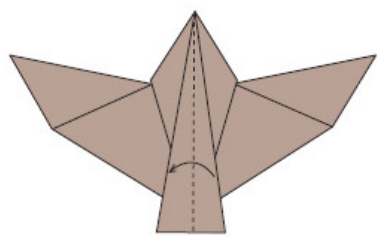
25. Open the layers out with valley pinches.



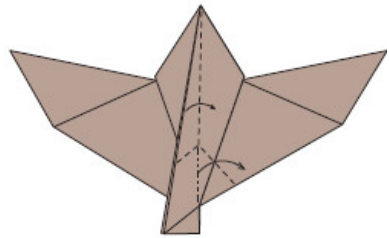
26. Fold the tail point upward.



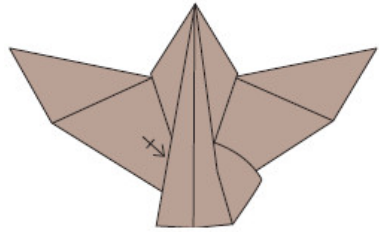
27. Bring the flaps inward. Turn the model over, left to right.



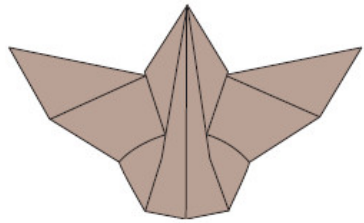
28. Valley-fold the center triangle in half, right to left.



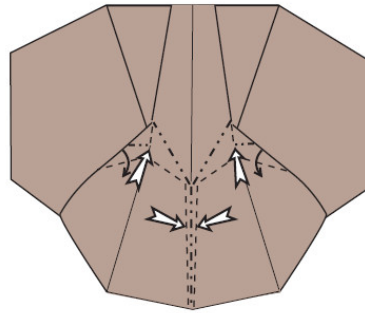
29. Pull out the lower right side with an inside-reverse fold at the lower section.



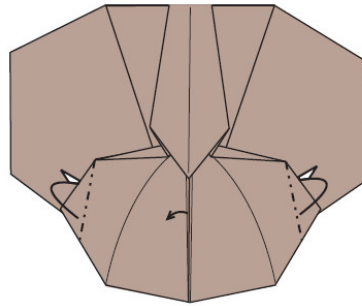
30. Repeat on the other side.



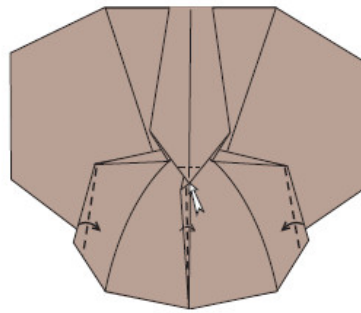
31. View of the back at this stage.



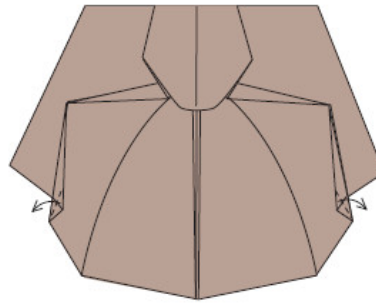
32. Define the tops of the legs by pulling flaps forward, tucking behind the tailbone.



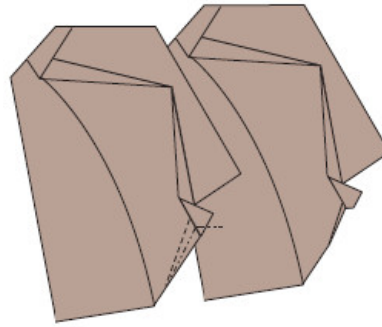
33. Mountain-fold behind.



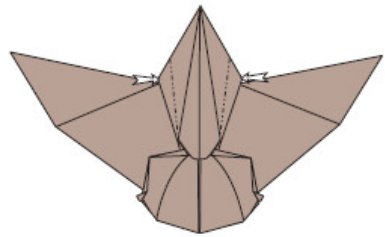
34. Narrow the tailbone. Valley-fold the upper edges of the leg.



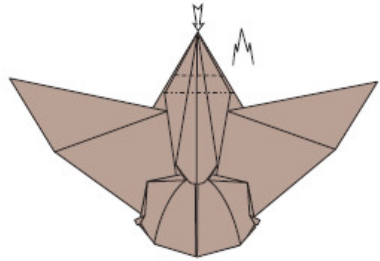
35. Fold the feet.



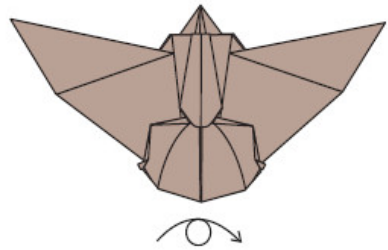
36. Mountain- and valley-fold a thin triangular shape at the back of the feet to form the calcar (spur-like projection).



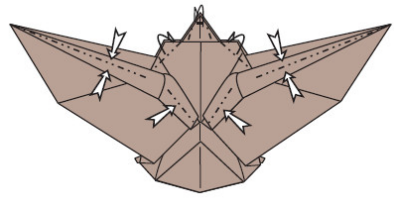
37. Push paper in to sink.



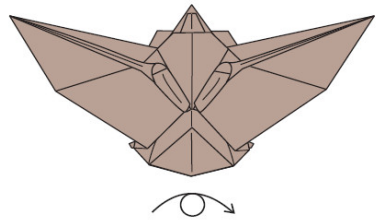
38. Crimp the head and neck area inward.



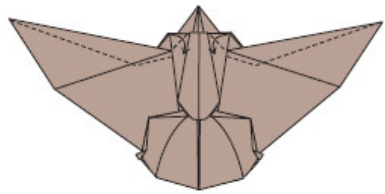
39. View from the top at this stage. Turn the model over, left to right.



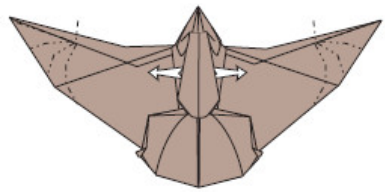
40. Accentuate the arm bones with mountain folds. Round out the chest and neck area. Shape the lower lip and jaw.



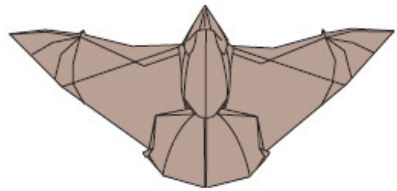
41. View at this stage. Turn the model over, left to right.



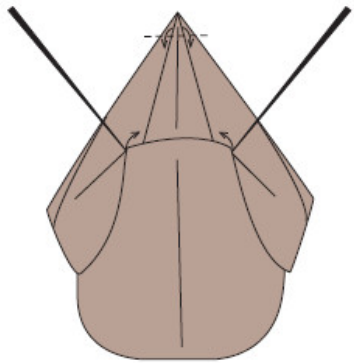
42. Valley-fold the head corners back for the ears. Valley-fold the tops of the arm bones from chest to wingtips following the path of the folded arm paper beneath.



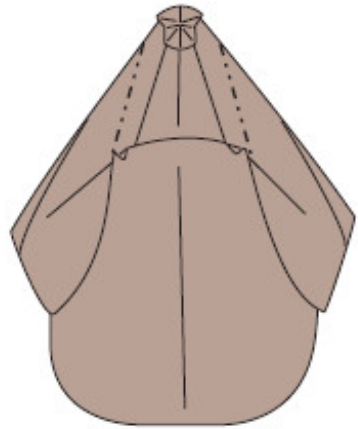
43. Form the finger bones with mountain creases. Pull out to round out the body.



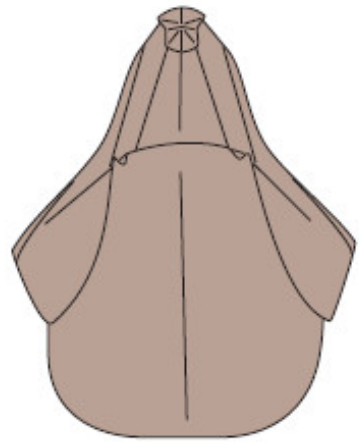
44. View at this stage.



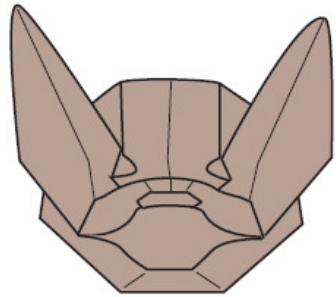
45. Detail of the head area. Open the eyes with the point of a pencil or wooden skewer. Spread-squash the tip of the nose at the end of the muzzle point.



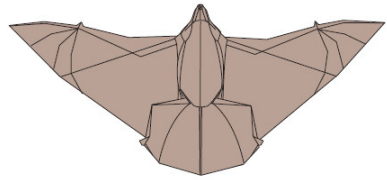
46. Round out the muzzle with mountain folds from beneath the eyes to each side at the end of the bat's snout.



47. Top view at this stage of the head detail.



48. Head-on end view of the face.



49. Top view of the finished Big Brown Bat.

praying mantis

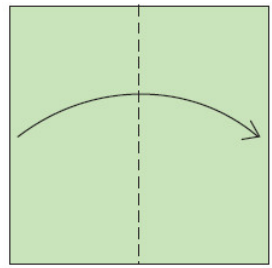
Designed by Michael G. LaFosse

Science fiction screenwriters could not dream up better alien life forms than these exotic-looking insects. Their apple green color, huge intelligent eyes, angular head and powerful arms make their form particularly interesting to me. During my summers at Vinton Pond in West Townsend, Massachusetts, I was able to study these insects in the nearby field of tall grasses. A few years ago, the OrigamiUSA directors met to inventory the forgotten collection of origami models stacked in a basement storage room beneath the American Museum of Natural History in New York City. We came across a box that I recognized. I exclaimed that we had found the original Praying Mantis I had folded in the 1970s as a gift to the late Lillian Oppenheimer, who was head of the Origami Center at that time. A director who was standing near me as I opened the lid

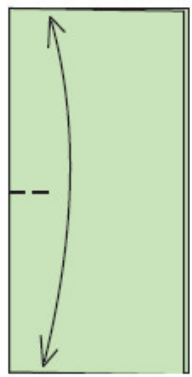
declared, "Nobody was folding anything like that in the seventies." I showed him the inscription on the box: "Michael G. LaFosse—1978." Although it was advanced for its time, present-day designers of super-complex origami models have far surpassed its technical achievements. Robert Lang, Satoshi Kamiya and others do not shy away from designing and folding any insect, no matter how complex it may appear.

PAPER SUGGESTIONS

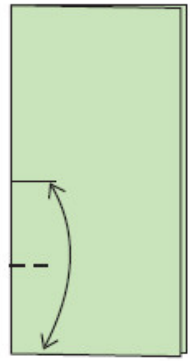
The paper must be tissue thin to render the legs so slender. We use overbeaten pulp (with super-hydrated abaca and hemp fibers) to make paper so thin you can see light through it. A 9-inch (23-cm) square will produce a 5-inch (12.7-cm) praying mantis. You may use commercially available art tissue or fine Asian tissue. Be sure to surface-size the Asian tissue before using.



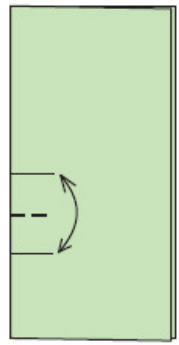
1. Fold the square in half, edge to edge.



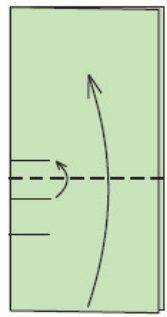
2. Pinch-fold the edge at the halfway mark.



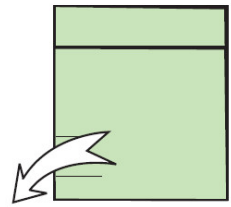
3. Pinch-fold the edge at the quarter-way mark.



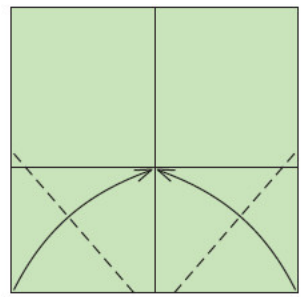
4. Line up the two pinch marks, one on the other. Pinch a third mark between them.



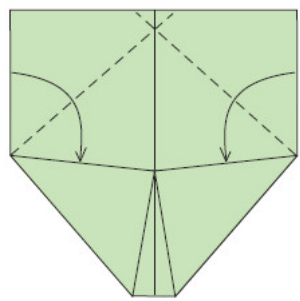
5. Line up the top two pinch marks, one on the other, and fold across.



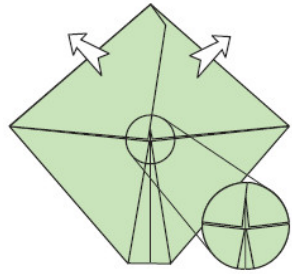
6. Open the paper completely.



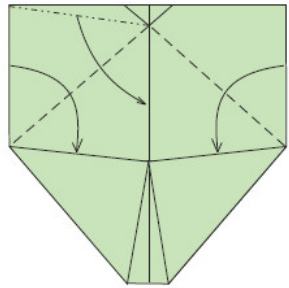
7. Fold up the bottom corners to meet where the creases cross.



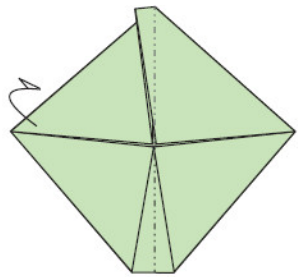
8. Fold the top left and top right edges down to align with the top edges of the lower corners.



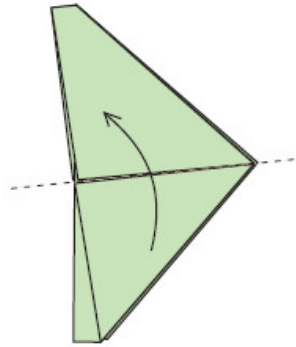
9. Notice that the corners from the top flaps will not intersect at the vertical crease. Open the upper corners back out.



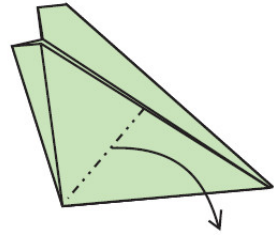
10. Return the top corners down while keeping the cut top edges on the outside and in the center. Flatten these edges to the left.



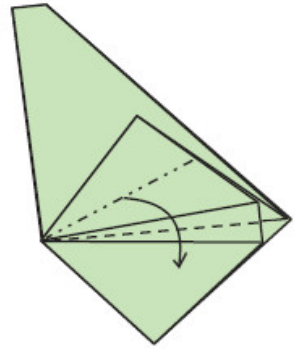
11. Mountain-fold the centerline, swinging the left side behind the right.



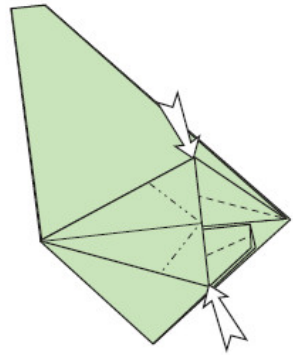
12. Valley-fold the lower flap upward.



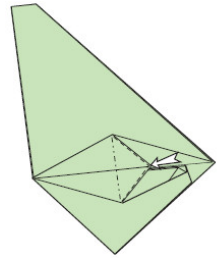
13. Squash the front flap downward.



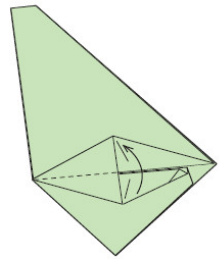
14. Stand up the top flap and squash it flat.



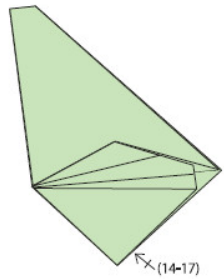
15. Inside-reverse-fold the points at the arrows.



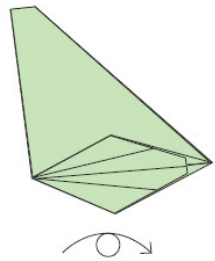
16. Tuck the triangle inside.



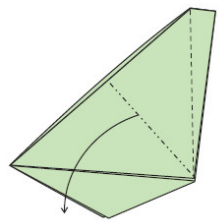
17. Bring the lower flap up over the upper flap.



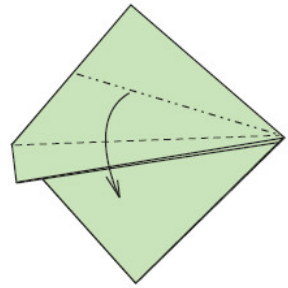
18. Repeat steps 14 through 17 with the bottom of the flap.



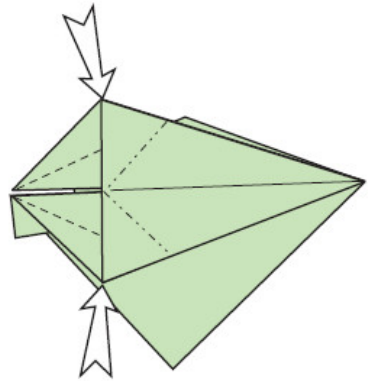
19. Turn the model over, left to right.



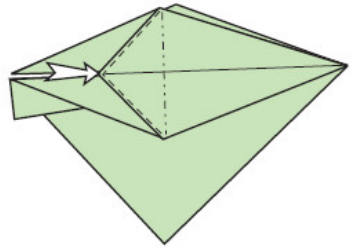
20. Squash the upper flap while holding the small flap closed, laying it downward.



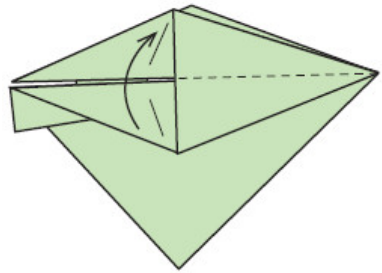
21. Squash the upper flap downward.



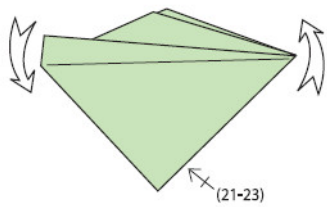
22. Inside-reverse-fold the points at the arrows.



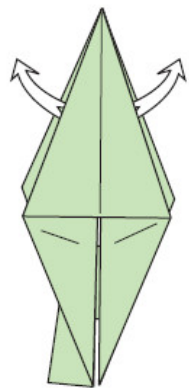
23. Tuck the triangle inside.



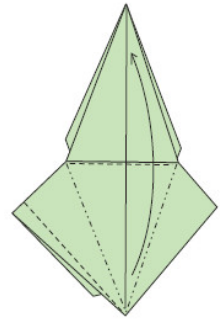
24. Bring the lower flap up over the upper flap.



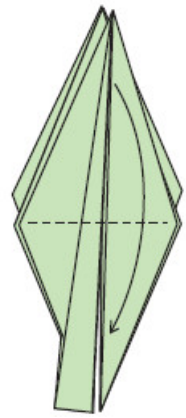
25. Repeat steps 21 through 23 with the other side flap. Rotate the model 90 degrees.



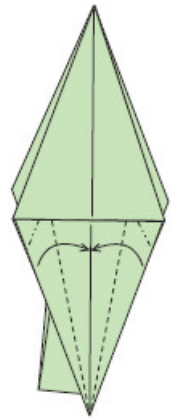
26. Find the free layers of paper behind the front top corner. Pull them out and bring them to the front. This will release them, forming a new flap in front. Move the flap down and flatten. Look ahead at step 27 for the shape.



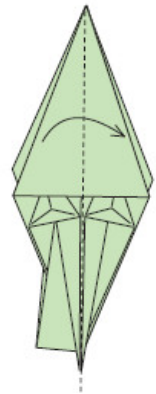
27. Petal-fold up.



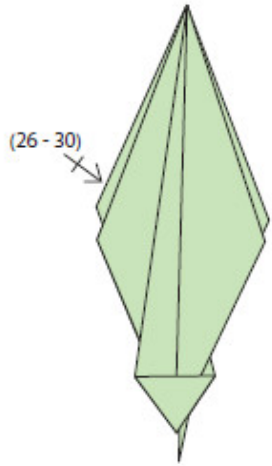
28. Fold the narrowed point downward.



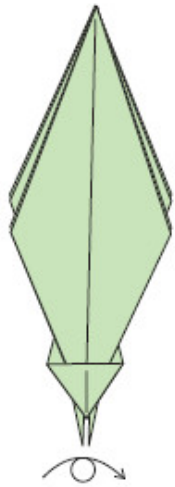
29. Fold the edges in, squashing flat the shapes under the top layer.



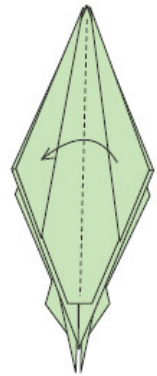
30. Flip the left layer to the right.



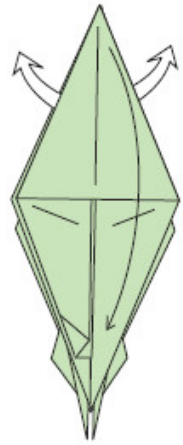
31. Repeat steps 26 through 30 on the right half of the model.



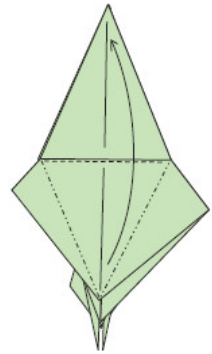
32. Arrange the layers symmetrically. Turn the model over, left to right.



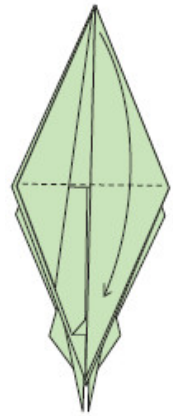
33. Flip the right layer to the left.



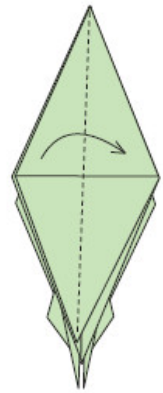
34. Pull out the layers from behind the top point and turn inside out.



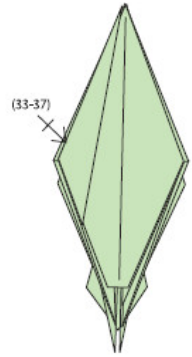
35. Petal-fold up.



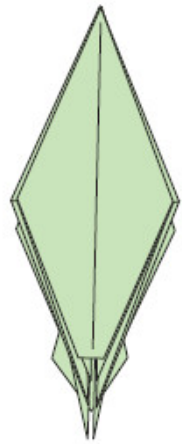
36. Fold the flap down.



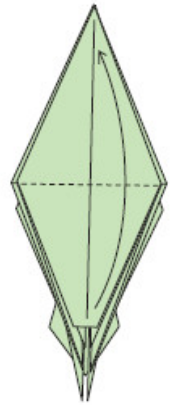
37. Bring the left side across.



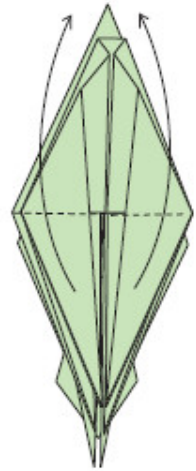
38. Repeat steps 33 through 37 on the other side.



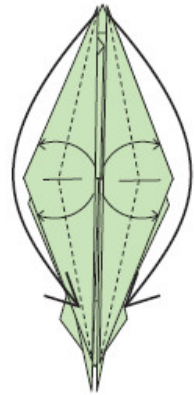
39. View of this stage.



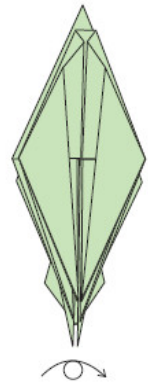
40. Fold the lower flap upward.



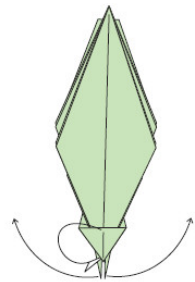
41. Fold the points up.



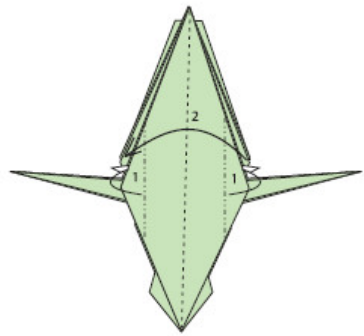
42. Bring the cut edges to the outer folded edges while moving the top points down.



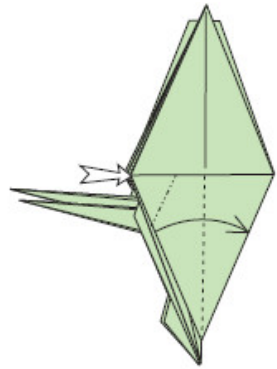
43. Turn the model over, left to right.



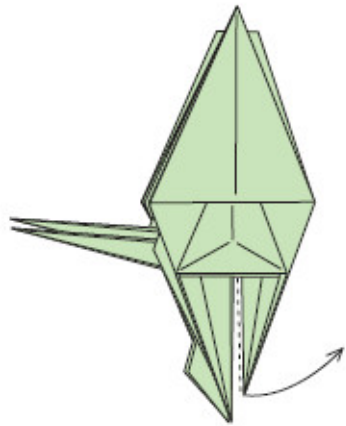
44. Turn the bottom shape inside out. Inside-reverse-fold the points to the side.



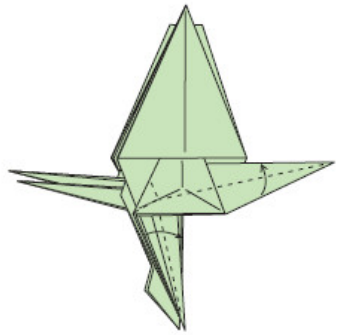
45. Mountain-fold the left and right corners inside (at number 1). Valley-fold the right leg layers to the left, exposing the indicated view (at number 2).



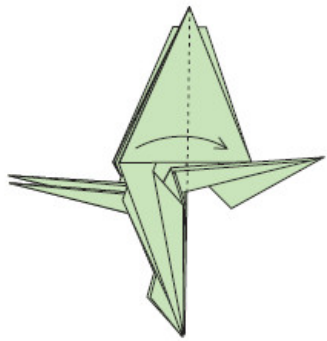
46. Squash-fold the point on the right to lay flat in front.



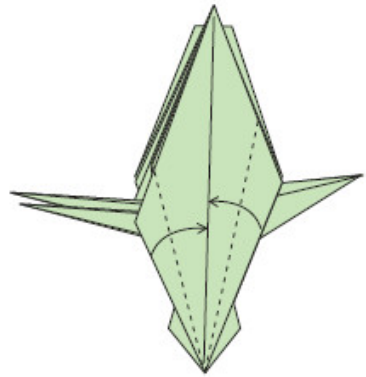
47. Inside-reverse-fold the right point straight out.



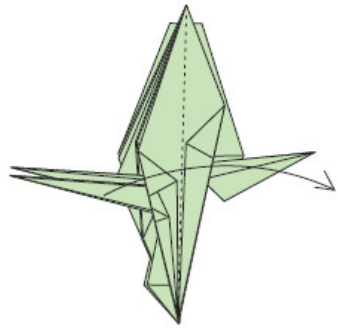
48. Make the right point narrower with a valley fold while bringing in the left edge to the centerline.



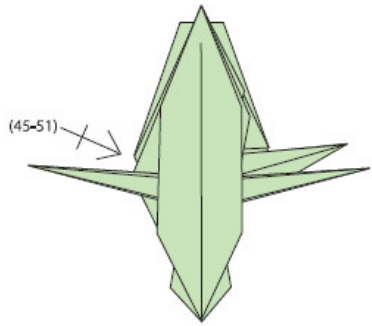
49. Bring the left flap across at the centerline.



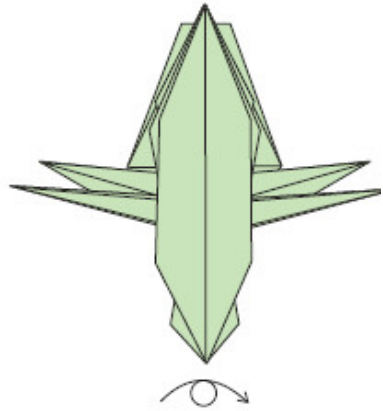
50. Fold the left and right edges to the center.



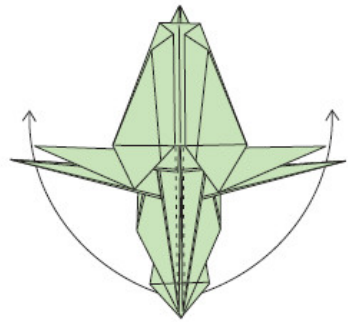
51. Move the top leg point and layers from the left back across to the right.



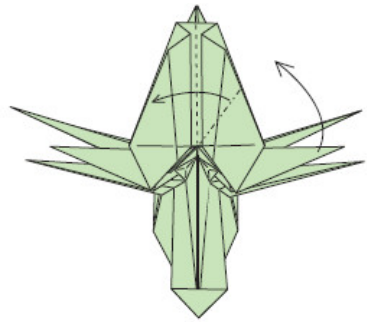
52. Repeat steps 45 through 51 on this side.



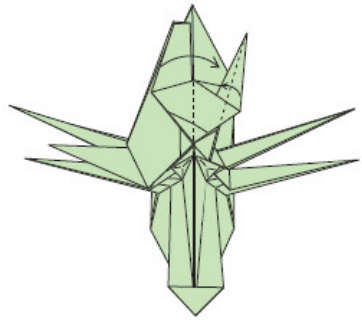
53. Turn the model over, left to right.



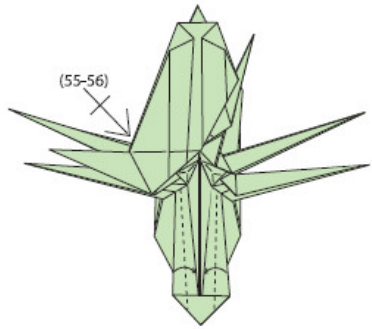
54. Inside-reverse-fold the legs out.



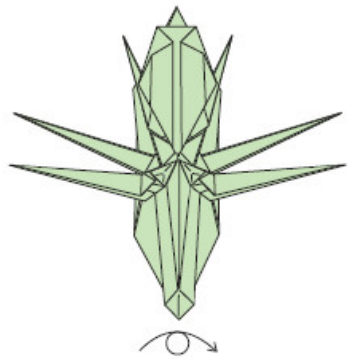
55. Swing the right front layer over to the left. Pull the mountain pinch and bring the indicated leg upward.



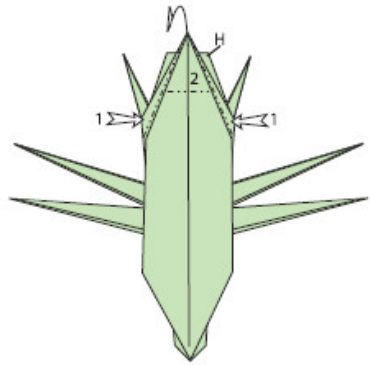
56. Fold the leg in half and bring the flap back over it.



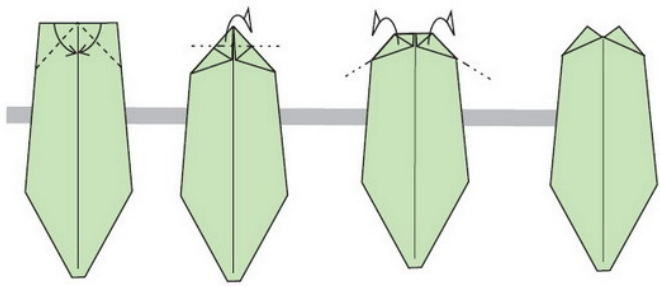
57. Repeat steps 55 through 56 on the other front leg. Fold the abdominal edges in.



58. Turn the model over, left to right.



59. Mountain-fold the edges in on each side of the head (at number 1). Mountain-fold the top point behind (at number 2).

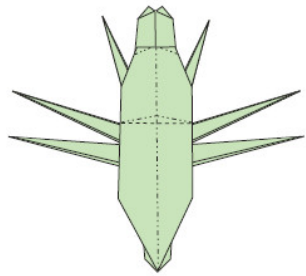


60. Detail of head folds: fold the top corners to the centerline.

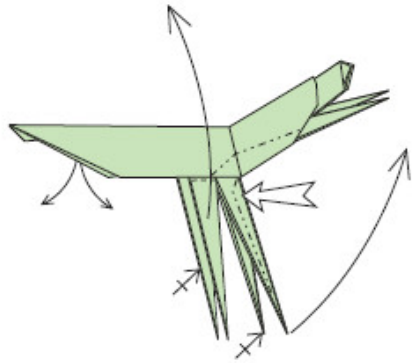
61. Mountain-fold the top point behind.

62. Mountain-fold the top corners over.

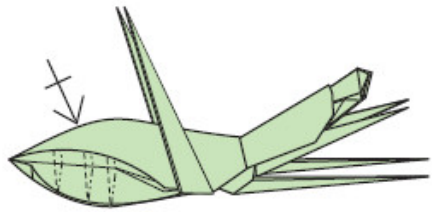
63. Note the two points at the top. These will become the mouth parts.



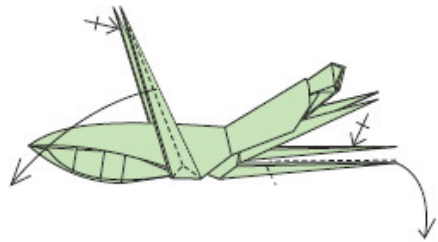
64. Mountain-fold in half along the top of the back only to the neck area. Crimp at the junction of the thorax and abdomen to raise the thorax. Round the top of the thorax with mountain folds at the corners.



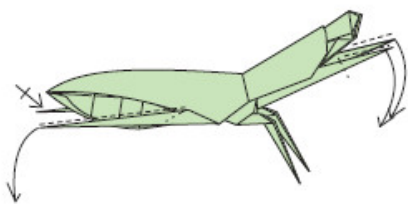
65. Pull out the layers of the lower abdomen. Fold the rear legs up. Narrow the thorax by mountain-folding the lower edges inward. Swing the middle legs forward by mountain-folding along the centerlines of the legs as seen from the sides.



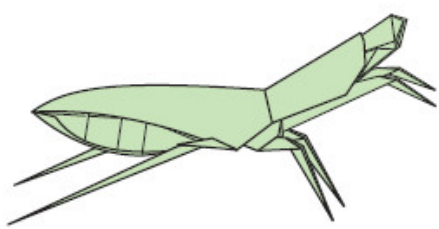
66. Create segments in the lower abdomen on both sides using a series of three pairs of mountain-valley pleats.



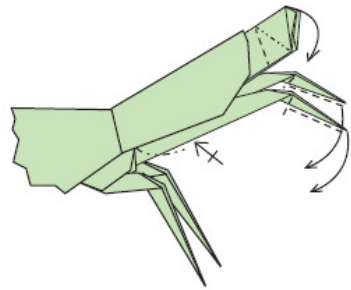
67. Rabbit-ear each hind leg to swing it toward the rear. Inside-reverse-fold the middle legs downward.



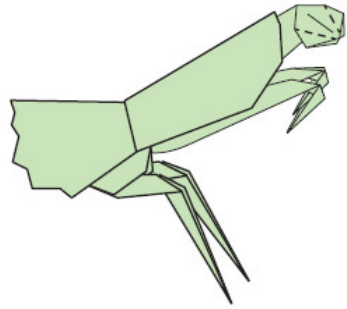
68. Inside-reverse-fold the rear and front legs down into position.



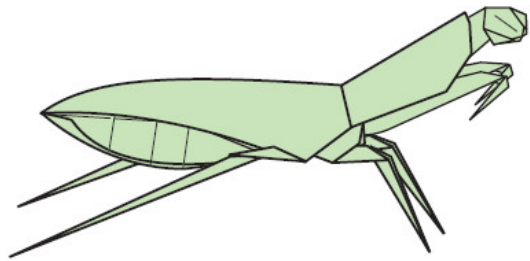
69. The result of step 68.



70. Outside-reverse-fold the ends of the front legs to point down. Squash-fold the head and check for symmetry. Make mountain creases at the base of the front legs to simulate the “elbows.”



71. Valley-fold head corners up to form the eyes. The basic folding is complete. Check all areas of the model for detail, adding touches here and there as needed for poise and realism. Stay within the limits of the paper’s ability to be shaped. Don’t overwork it.



72. The finished Praying Mantis.

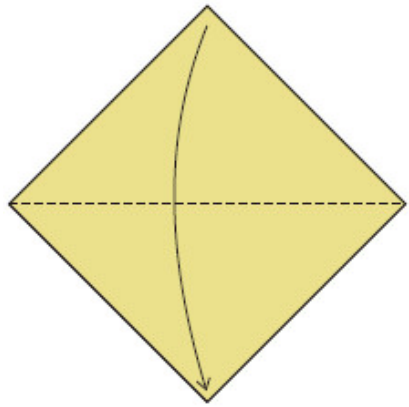
Panther Mask

Designed by Michael G. LaFosse

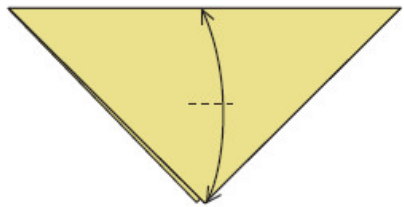
I designed a similar mask during my artist-in-residence experience at the Arizona-Sonora Desert Museum in Tucson, where an actual mountain lion was their early mascot in the 1950s. Another art-residency, this time at the Morikami Museum and Japanese Gardens in Delray, Florida, reunited me with his cousin, the Florida panther. Unfortunately, these cats are gaining increased newspaper publicity because of conflicts with humans as our suburbs encroach on the wild cats' natural habitat. This subject reminds us that we share the planet with other creatures, which deserve our protection and respect. This model also allows us to explore the paper mask, a time-honored and versatile use of paper art. Some say that masks often resemble their folders since we are most familiar with the proportions of the features of our own face.

PAPER SUGGESTIONS

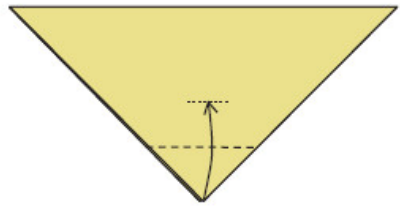
Use a heavy art paper, colored the same on both sides. An 18-inch (46-cm) square will produce a mask 8 inches (20 cm) high.



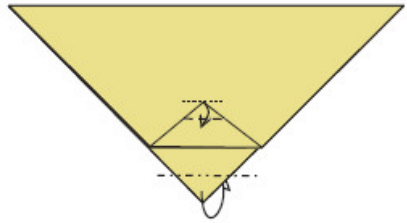
1. Fold in half, corner to corner.



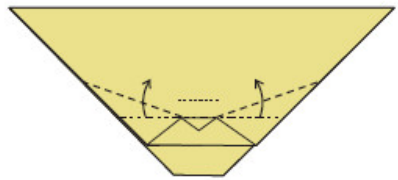
2. Make a pinch mark in the middle of the paper.



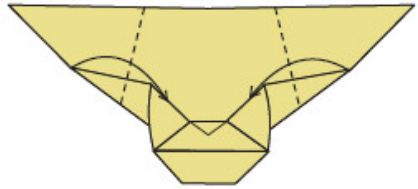
3. Fold the bottom corner of the top layer to the middle of the pinch mark.



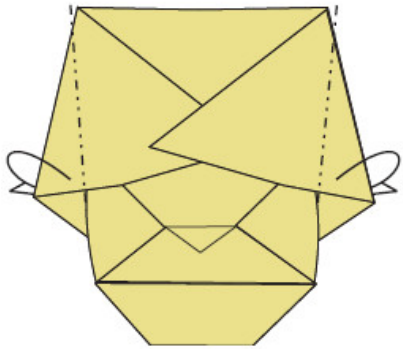
4. Fold the corner down, about one-third. Mountain-fold the bottom corner to the back, displaying an amount equal to the folded shape above it.



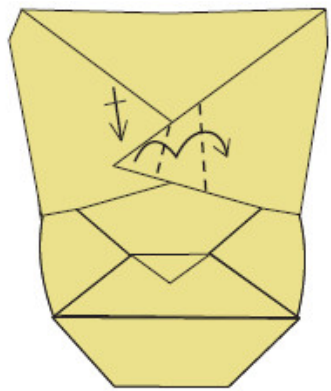
5. Mountain-fold straight across the edge at the top of the nose. Grab a mountain crease edge from one side of the nose and move it higher up the face. Valley-fold. Repeat with the other mountain crease. This will form the muzzle.



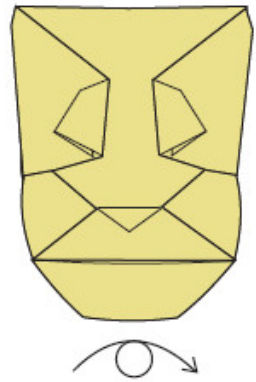
6. Fold the left and right corners over the face. They will cross over each other. Look ahead at the next step for guidance.



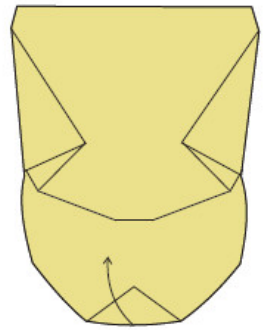
7. Mountain-fold to the back.



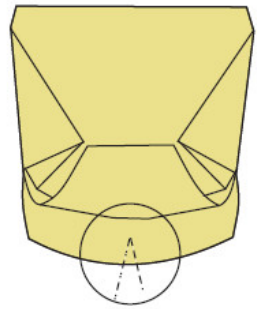
8. Fold the corner over and over for an eye. Repeat with the other corner.



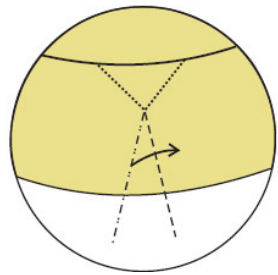
9. Turn the model over, left to right.



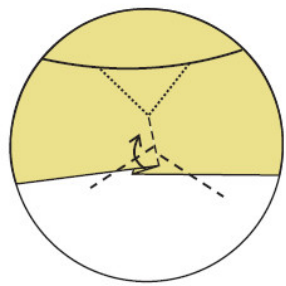
10. Lift up the lower jaw to clear the way for the next step.



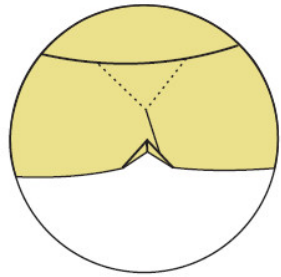
11. Mountain- and valley-fold a dart in the middle of the bottom edge.



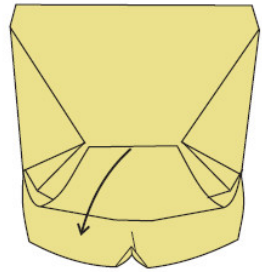
12. Detail. Notice that the top of the dart stops at the X-ray view of the bottom of the nose paper, which is on the other side.



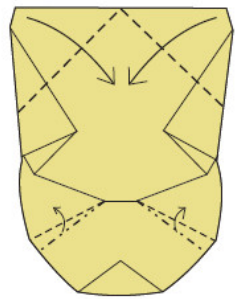
13. Lock and shape the dart by folding the center up, making symmetrical valley folds on each side. This will be the middle of the upper lip.



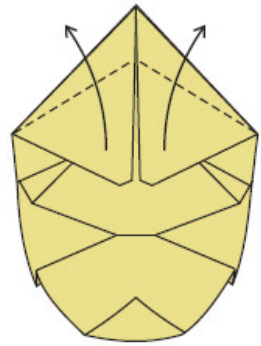
14. The completed lip.



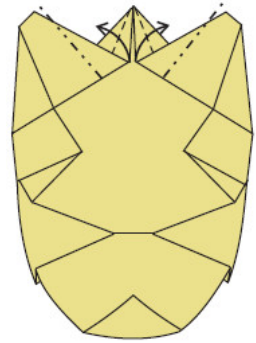
15. Replace the lower jaw.



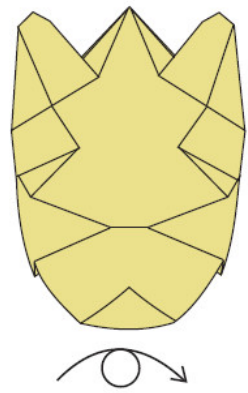
16. Fold the top corners down, forming a point in the top center. Mountain- and valley-fold the left and right sides of the lower jaw.



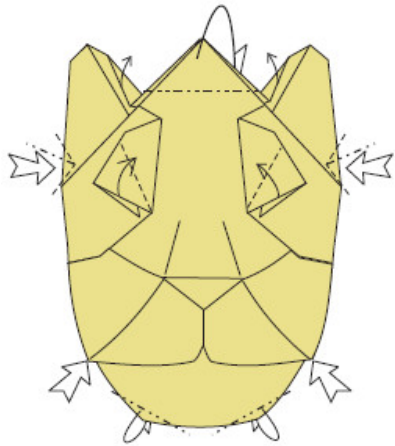
17. Fold the points out for the ears.



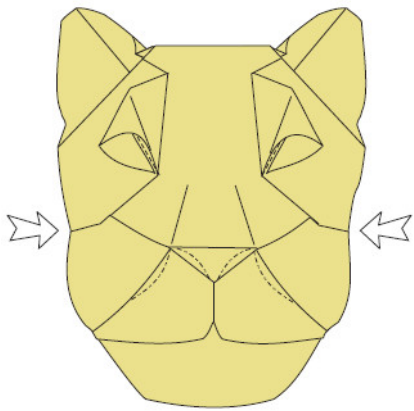
18. Inside-reverse-fold the top of each ear.



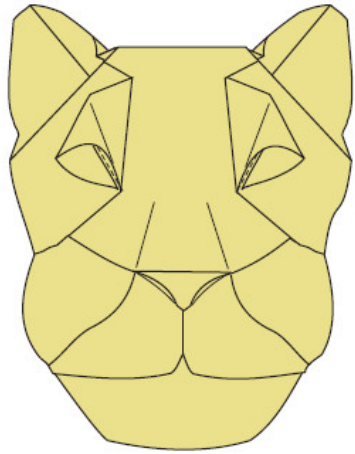
19. Turn the model over, left to right.



20. Fold the top point behind. Crimp in the bottom of the ears. Open the eyes. Round and shape the sides of the mouth and the bottom of the chin.



21. Apply curved folds to the nostrils and muzzle. Push in the sides of face to accentuate the muzzle.



22. The finished Panther Mask.

MAKING YOUR OWN ORIGAMI PAPER

Why make your own paper for origami? You may find, as I have, that what you require for a special origami project just does not exist! The right qualities of color, texture, thinness, durability and size are a lot to ask for in just one sheet of paper. Perhaps you need a sheet that is 25 inches (63.5 cm) square, all yellow on one side and all black on the other. Oh, and the paper must be matte finish and as thin and as strong as a new dollar bill. Or maybe you require a paper that is the color of an elephant, with a convincing texture like an elephant's hide, and it must also be white on the other side so that the tusks will display well.

There are so many parameters that existing papers will not have for your special project, and so the only practical alternative is to make the paper you need yourself! I felt that way early on in my origami career and so I jumped right into the subject. Granted, I did not know much about papermaking, and the paper-makers who I met knew even less about origami's requirements. So I had to discover for myself what to do about it, and I developed formulas and methods that make high quality papers for just about any origami project that I could develop. And the papers are archival, meaning that with reasonable care the paper will not become brittle with age and the colors will not fade; in other words, my creations will last for generations to enjoy.

You will benefit from my accumulated experience and can begin leagues ahead of my first start in hand papermaking. You also have another advantage that I did not—quality hand papermaking supplies and equipment are readily available.

A small sample of Origamido handmade paper in a variety of colors.

TOOL AND MATERIALS

The basic equipment and materials you will need to get started in hand papermaking are:

Vat: A suitable tub to contain the pulp and water for sheet formation.

Papermaking mould: This is usually some sort of screen, sometimes with a frame, to lift a felted web of pulp out of the vat.

Felts: To lay the screened pulp upon for pressing to remove water.

Pulp: Plant fibers beaten in the presence of water that can be suspended in a vat of water for sheet forming. You can reconstitute existing paper with a kitchen blender or you can order specially prepared, ready-to-use pulps from a supplier. A professional pulp beating or refining machine should be purchased only if you become a habitual, high-volume papermaker. There are many good sources of quality prepared pulp for you to use.

Colorants: Many kinds of colorants can be used— dyes, paint, pigments—either before or after sheet forming. The most permanent colorants are pigments of insoluble inorganic powder oxides.

Pressing and drying system: These can be as simple as an absorbent cloth for pressing out excess water, and paper blotters for drying the handmade papers between. Hydraulic presses are readily available, and air-blown drying boxes can be inexpensively built. These are most efficient for large batches of paper.

PULP PREPARATION

The experts say, "The quality of the paper is made at the pulp stage." This is so true. The selection and preparation of your fiber completely predicts its performance through all of the later stages and hence its

ability to become good quality paper.

You can make your own paper pulp from scratch or you can buy prepared pulps in various stages of processing. If your paper fiber is to come directly from a plant, you must first separate the plant fibers with careful harvesting, cooking and chemical conditioning to remove non-cellulose constituents: lignins, starches, sugars, waxes, gums and fats. This is difficult and painstaking work that requires different techniques for different plants and usually calls for cooking the pulp source in a mildly caustic solution. This must be done carefully and the pulp should be rinsed thoroughly to rid it of any residue of caustic solution. The cooked pulp must then be beaten by hand or by machine. The degree of beating depends on how fine the paper is to be.

I sometimes like the aesthetic qualities of plant remnants left in the paper, especially when the paper is used as a background for a framed model of a living creature. It is also particularly satisfying to make origami animals from the fibers of the plants in their own habitat, as we did for the Arizona-Sonora Desert Museum in Tucson. There is some connection between the wildlife art and the creature's actual habitat, which we hope is not lost on the viewer.

So, yes, it is possible to make suitable paper from plants that you harvest yourself, and there are several good books on the subject. If you want excellent paper without so much trouble, you can order partially preprocessed fiber called "half stuff," or even totally beaten pulp that you can reconstitute with water, blend and color to your own specifications. Purchasing pre-beaten pulp is generally an attractive and much safer alternative to stripping bark and cooking plant parts in lye.

Most popular papermaking fibers are readily available from specialty suppliers; their contact information is listed in this book or found online. You can purchase dry pulp in sheet or shredded form, which is perfectly useful for origami papermaking, or as beaten pulp. The dried pulp stock can be reconstituted, colored and formed into sheets of paper. You will not, however, obtain the strongest, crispest sheets unless the pulp is properly beaten, and to properly beat the pulp you either need to beat it by hand or use special mechanical equipment. Commonly available fiber choices are cotton in linter (seed hair) and rag form; abaca (*Musa textilis*), a type of banana plant cultivated in the Philippines; true hemp (*Canabis sativa*); and flax

(*Linum usitatissimum*).

When you purchase ready-to-use beaten pulp from specialty suppliers, you must know what to ask for. You would not ask a butcher for ground beef when planning to prepare a rib roast. The fiber choice, or blend, and the beating time are essential! I recommend that the novice try a blend of 80 percent abaca, of any kind, and 20 percent first-cut cotton linters, beaten for just one hour. This formula will produce a strong sheet that is easy to form with most student-style molds. This blend drains quickly and without holes, even in fairly thin sheets, and is also easy to color.

If you require thinner, stronger sheets, you must order your pulp "overbeaten." This means that the beating cycle will be at least three hours long and up to twelve depending on the fiber species and the desired quality. Generally, the longer the beating time, the crisper the paper. You can go too far if the fiber is not up to the task. I suggest using abaca or raw flax for pulp that will be beaten longer than six hours. Shrinkage will be high, which means that thickness will be greatly reduced—a real plus, by measure of strength and thinness, for the complex folder—so sheet forming must be tested for true dry-state form. Colors will be more intense due to greater translucency. We test small patches of screened pulp for color, strength and thickness by drying them in our microwave oven for just a few seconds.

Regardless of the greater cost per pound, you should seriously consider ordering beaten pulp over dry. It will be stronger and take color better. The pulp will be shipped in sealed pails, usually in 5 gallon size, and contain approximately 2 pounds, dry weight, of beaten pulp.It would take many years to amortize the cost of a beater verses the small premium a professional charges to prepare your pulp for you. If, however, you find yourself making thousands of sheets of paper a year, get a beater!

Beating

If you decide to start with unbeaten pulp, the fiber, whether pre-processed or extracted on your own, must be hydrated and beaten to separate and fray the strands of cellulose. Beating may be done by hand or by machine. Whirling pulp in a blender is not beating it, but mostly just separating it. By beating the pulp, you are increasing the

surface area while incorporating water molecules into the cellulose wherever the strands are mechanically separated. The more surface area you can produce, without making the fibers too short or weak, the more potential hydrogen bonding surfaces will result, making a strong, crisp sheet.

Traditionally, a Hollander is used to beat paper pulp. There are other kinds of beating machines but the Hollander is the most common in studios. It quickly flattens and frays the plant fibers, making them swell with water. It does this by grinding the fibers with dull metal blades against an adjustable bed-plate. The action can be adjusted by changing the distance between the blades and bedplate. The closer the bed to the blades, the more bruising and splaying; the more open the gap, the less the fibers are separated.

A Hollander paper pulp beating machine made by Valley Iron Works.

A typical beater cycle at our studio would include the following routine. First, the beater is loaded with the correct amount of water and prepared fiber (cooked or reconstituted from dry sheet). In the case of our Hollander beater, we use 6 gallons (23 liters) of water to 1 pound (0.5 kg), dry weight, of fiber, which is a ratio of 50:1. With the motor turned on, the fiber and water are given fifteen minutes to

circulate freely in the trough. The gap between the blades and the bed-plate is left wide open so that the fibers have a chance to disperse in the water; this is called combing. Once dispersion is satisfactory, the bedplate is brought to bear against the revolving blades and the fibers are bruised, pulled apart and frayed; this is beating. For most of our blends, we beat the fiber for two hours. This produces a strong, crisp sheet with good tear resistance. For certain papers, such as paper for folding origami insects, the beating cycle can be as long as eight hours. This produces a paper that has very strong tensile strength and high shrinkage. We form these sheets tissue thin.

You can also use a pair of wooden mallets and beat the pulp by hand. Very strong paper can be made this way but it is tough work (I know, I used to do it) and not always successful. You must be very thorough, testing the pulp regularly and picking out any unbeaten bits before sheet forming can begin. The action is tough on one's hands if not done with care. Never pound the mallets to the point of jarring your joints. Let the weight of the mallet do the work. Be relaxed. Beat about one cup, by volume, of pulp at a time. To test the degree of beating, use a small clear jar of water. Add a sample of beaten pulp. Vigorously mix the pulp and water. If the pulp disperses easily and finely, with no unbeaten clumps or rapid settling, the pulp is ready for papermaking. This is called the jar test, and it works as well for testing pulp beaten by any beating method.

BASIC PAPERMAKING STEPS

Papermaking, like cooking, proceeds well if you take the time to prepare your materials and your work area properly. You do not need complicated or expensive devices, just a little organization and a lot of care.

Each kind of paper has its own special requirements. Know them before you purchase and prepare your materials! I have taken care to detail as much information as possible to aid you, but do not be alarmed if your first batches of paper do not come out exactly as you envisioned. There are many variables at play, especially when processing a natural material, and you may need to approximate, substitute and experiment should you not be able to strictly follow a particular recipe. You will find, however, that your fist batches of paper seem quite miraculous on their own. The sheer surprise of

finding crisp, dry, foldable sheets of paper in place of the wet, lumpy, fragile webs of pulp that you put in the drying box is addictive, and you will want to try again and again. Keep your first recipes simple and have fun.

Add the retention agent to the beaten pulp. Mix well.

Add inorganic pigment to the beaten paper pulp after the retention agent has reacted with the pulp. Mix well. Rinse the pulp, if desired, to remove superfluous pigment.

Mix two batches of colored pulps to produce a blend of colors.

Step 1: Coloring

Once you have prepared and beaten your pulp, the first step is to add coloring. Permanent papers require special colorants that will not fade or adversely affect the fibers chemically. Many commercial papers are dyed with chemicals that will fade or change over time, especially when exposed to ultraviolet light sources, such as the sun. But pigments such as carbon black and iron oxide are permanent colorants. Various mixtures of oxides of iron provide permanent earth tones in hues of browns, reds and yellows. There are also many other excellent pigment choices for coloring paper and by blending them you can achieve almost any color you desire. Be sure to choose pigments that are environmentally safe, and non-toxic. Ask your supplier for appropriate Material Safety Data Sheets and follow those instructions carefully.

Pigment particles are usually insoluble in water, so chemical retention agents are useful to help bond the colorant to the plant fibers. The retention agent is a cationic substance that when added to

the pulp applies a positive charge to sites along the fibers of that pulp. The pigment particles are commonly negatively charged, and so when added to the pulp/retention blend they are bonded, electrostatically, to the surface of the fibers. It is important to add the correct amount of retention agent and pigment based upon the dry weight of the pulp to get a successful coloring operation without wasting valuable pigment. Follow the supplier's recipe carefully.

Another material you may want to add to your paper at the pulp stage is mica. Many of our animals— frogs, birds and butterflies— often seem more alive when we add powdered mica to the formula. The sparkle adds a quality of depth to the paper, and the paper often catches the spotlight in desirable ways when the works are being exhibited. Indeed, richly pigmented papers with inclusions of mica make the folded frogs actually appear wet. The grackles folded from our handmade papers shimmer like the real birds, and the paper butterfly's wings sparkle with life.

Step 2: Sheet Forming

Once you have colored your prepared pulp, you are ready to form sheets of paper. The most common method of forming a sheet of paper is to use a screen with a frame or deckle, to scoop a prescribed volume of the prepared pulp from a suspension of water. To do this, pour your pulp into a vat of water. Next, dip your screen and deckle into the water and scoop up the pulp. Try to level the pulp on the screen and allow the water to drain. After the water drains through the pulp, the pulp is transferred from the screen onto a wet felt, pressed and dried to form a sheet of paper. We form larger sheets by pouring pulp slurry directly onto dammed screens, and we form even larger sheets by spraying the pulp slurry onto stretched fabric, such as a bed sheet, using a pattern pistol spray gun and an air compressor.

Add the colored pulp to the sheet-forming vat. Agitate well to disperse the fibers evenly.

Scoop the pulp suspension onto the screen. This is called “pulling a sheet.”

Raise and level to "gel" the fibers on the screen while water drains through the screen.

A pulp layer on the screen after the frame has been removed.

There are many methods for "pulling" a sheet of paper. The size of the paper determines the pulling method. The origami paper most of us are used to is 6 inches (15 cm) on each side. Many origami sculptures require paper perhaps five to ten times that area. Hand papermaking methods for one person can be exhausting if the deckle and frame (screen) is more than about 20 inches (50 cm) wide. Mechanized contraptions allow larger screens to be raised from the vat of pulp, and truly large sheets can be formed by pouring the pulp

slurry onto a screen. At Origamido Studio, we have a glass table that measures 6 feet (1.9 m) on each side, and we also have a roll of felt 6 feet tall. This allows us to couch screened pulp, end to end, to cover the entire felt on the glass if we want to. This leaves ridges of double-thick pulp at the junctions, and while these can be pounded away, most of the larger sculptures we make are from papers that are sprayed, poured or constructed from smaller sheets after the paper is dried.

The type of fiber will influence the type of sheet one can easily form. Some pulps are so highly hydrated that their loose mash of fibers drains slowly. These often allow one to make paper that is extremely strong, and so it can be quite thin. Often this paper can be made too thin, in which case we double-dip the screen in order to lay down more pulp. Sometimes we couch two sheets together, one right on top of the other. This is great when the model requires duo paper —a sheet with two colors, one on each side. Each layer of pulp can be of a different color!

Commercial papermaking equipment never seems to be designed to make square paper. This bothers some of our students, but we do not mind. Handling the formed sheet before drying can cause it to stretch, and so when it is handled on the shorter edges, those deformities will be trimmed off anyway when the paper is made square. The excess paper allows us to select the best portion of the sheet for the desired square, then keep the margin sample for future reference. These scraps are often useful for our customers—artists, folders and other people who want to test the strength, heft, or folding qualities of a particular type of paper without destroying a nice expensive sheet.

The pouring method is useful but tricky. We have a screen that allows forming a piece of paper 30 by 40 inches (56 by 101 cm) by pouring the pulp slurry onto the screen and allowing it to drain through. The art of forming a perfect sheet is often selecting a series of felts, screens and underlayments to retard the flow of the draining so that the pulp will be of uniform thickness. Chemical agents can also be used to change the viscosity of the pulp slurry. Sometimes we insert a plastic sheet over the screen, then pull it from underneath the slurry, much like yanking a tablecloth from beneath a set table, so that the velocity of pouring the pulp at one location is negated. We often pour the slurry into a pan or bowl in the center of the screen to

accomplish the same thing. Large paper is expensive, since imperfections are more likely in the larger area. The methods for handling, pressing, drying and storing the large sheets are more involved, and the equipment (felts, blotters, board and the like) is often more costly and requires more real estate for storage and use.

Step 3: Pressing

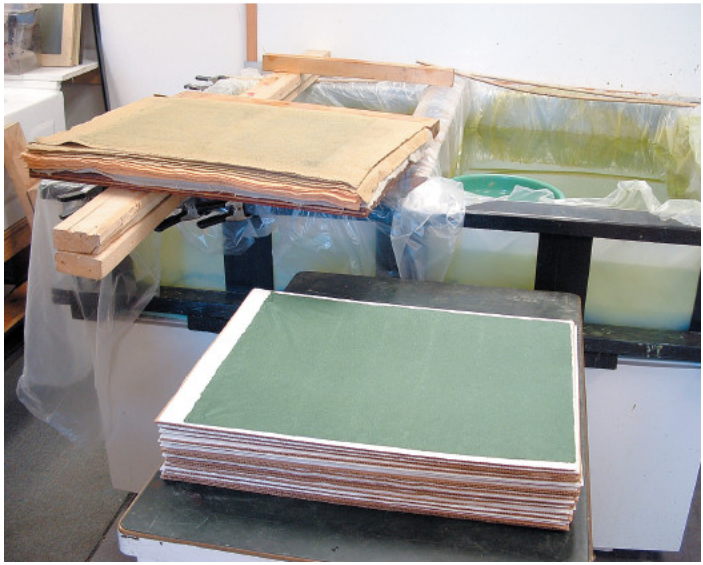
Once you have formed your sheet, it must be transferred to a piece of wet felt. The paper is then pressed to remove water, improve bonding (and resulting paper strength) and to make the mat of fiber thinner. This increased density also enables us to physically handle the paper in order to carefully remove it from felts so that we can place it onto blotters (or onto another drying surface, such as glass). De-watering by pressing is a physical process, and there are many techniques available to the hand papermaker for removing water. The simplest is to stack the pulp while on the felts, between boards, and then apply pressure. Another common method when forming large sheets is to cover the felt and pulp layer with a sheet of plastic, form a seal on the sides and, using a vacuum pump, remove the air from under the plastic sheet. The vacuum reduces the pressure between the table and the plastic, allowing the weight of the atmosphere to press the paper. Other papermaking presses utilize large rollers, crank-type jacks, hydraulic jacks and a variety of mechanical levers.

Transfer the wet pulp layer from the screen onto the wet felt.

Lift the screen after transfering the pulp layer onto the wet felt.

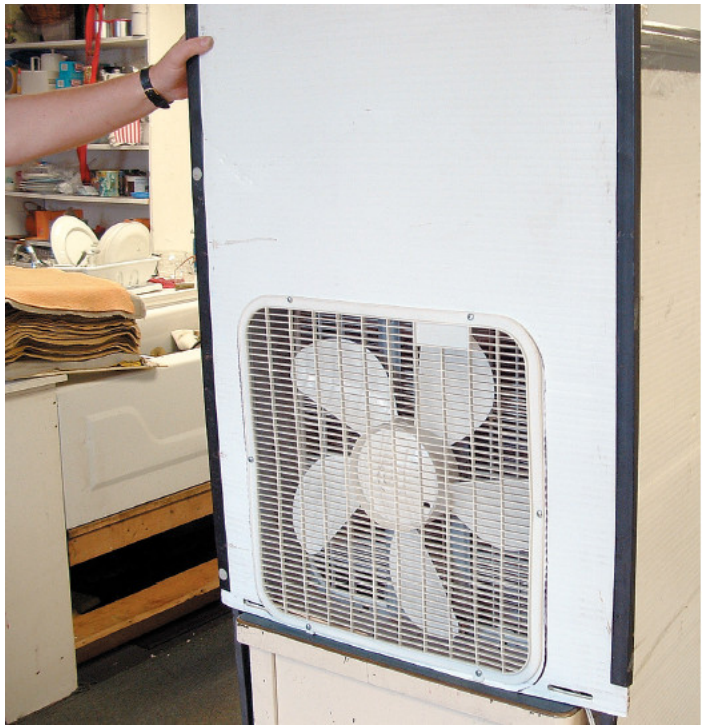
Press the wet felts (and layers of wet pulp between each felt) using a hydraulic “bottle jack.”

Remove the pressed pulp layers from the felt surface after pressing much of the water out of the paper.



The pressed pulp is now strong enough to transfer onto dry blotters.

The paper dries between blotters and corrugated cardboard, forming a stack, or “drying post,” in the drying box.



This is our portable drying box constructed of corrugated polyethylene and a 20-inch (50-cm) box fan. Air blows through the corrugations and speeds drying time. The paper is usually dry the next day.

Pressing improves the bond strength of the paper by providing a more intimate contact between hydration sites of the beaten, frayed fibers. Think of strands of cooked spaghetti. If you lay them on a pan and then allow them to dry, they may or may not stick together. If you press them together between boards (using wax paper) and then allow them to dry, they will bond to form a mat. The more pressure, the more contact and strength of the resulting mass.

Step 4: Drying

The simplest method of drying a sheet of paper is to just leave it alone. This is called "loft drying," because freshly pressed sheets of handmade paper were often given a first drying by hanging them over ropes in a barn loft where hot air collects. This type of drying promotes the strength of the sheet because the fibers may be able to

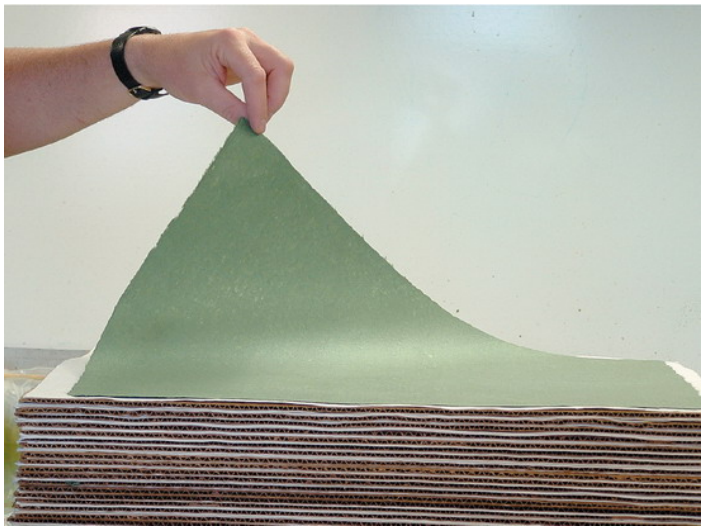
pull in together as they dry, forming a tighter knit. The trade off is that the sheet will dry wild, not flat. This is especially evident in sheets experiencing high shrinkage, such as paper made from overbeaten pulp. These papers can be made flat by wetting them once again and then re-pressing in a blotter-type dryer. Though this is an extra step, it is worthwhile if you will be applying an external size to your sheets. The size will re-wet the sheet and then you can dry it restrained.

When you want a flat sheet, you need to restrain it while it dries. The most common methods are to either hold or press it between blotters or brush it onto a drying surface, such as a piece of glass, a smooth board or a metal pan. Many commercial driers have heated, polished metal surfaces. When we produce paper at the Origamido Studio, we currently make between 100 and 200 sheets at a time, so we use a ventilated stack drying system. This method requires placing each wet pressed sheet of pulp between blotters; this sandwich is, in turn, placed between two sheets of corrugated cardboard. A stack of these sandwiches is built so that all of the corrugations run in the same direction through the stack, allowing air to be blown through the corrugation voids to quickly remove moisture wicking from the wet pulp into the cardboard. This removal of moisture will dry the sheets. We were able to construct a portable dryer by wrapping the ventilated stack with heavy plastic sheeting, duct-taped to the front of a standard 20-inch (50-cm) box fan. This worked well but it wasted too much plastic and tape. Eventually, we fashioned a portable two-piece collapsible corrugated polyethylene enclosure that we could adjust to any height of paper post. Nylon ratchet straps or rubber load ties (bungee cords) hold it snugly together, and we add weight to the top of the enclosure (and to the post of wet paper below) as the paper is drying. This is easily accomplished by stacking on the plywood panels and wet felts we removed after pressing the wet post. The drying box can be disassembled when the paper is dry, usually the next day. If the weather is humid, the drying process can take much longer.

Exit end of the drying box, showing the post of corrugated cardboard, blotters and pressed (but still wet) paper.

Step 5: The Finished Sheet

You now have a sheet of handmade paper. Enjoy using it to fold your origami model!

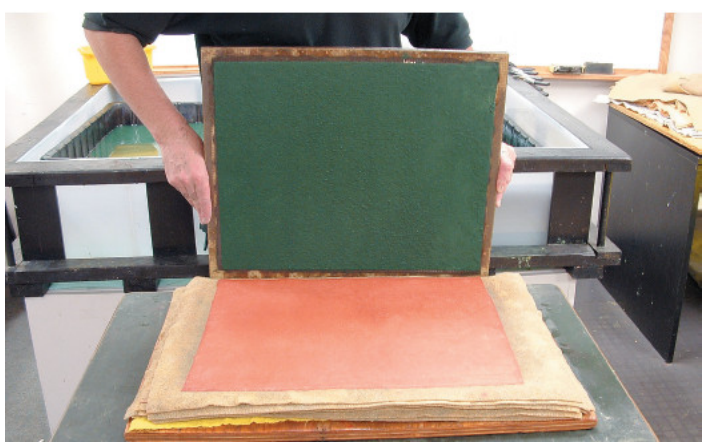


A dried sheet of handmade paper is peeled off the blotter.

MAKING DUO PAPER

Once you are able to make a sheet of paper, it is easy to make your own duo paper. Just follow the steps above to form a sheet of paper. After you have transferred a sheet to the wet felt, follow these steps:

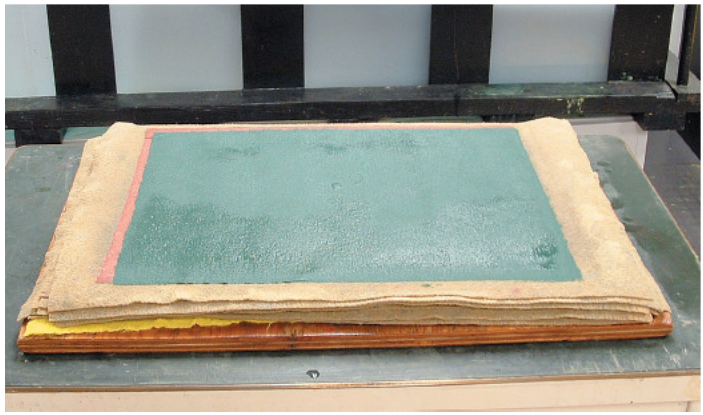
1. We begin by couching a thin layer of the first (red) wet pulp onto the wet felt.



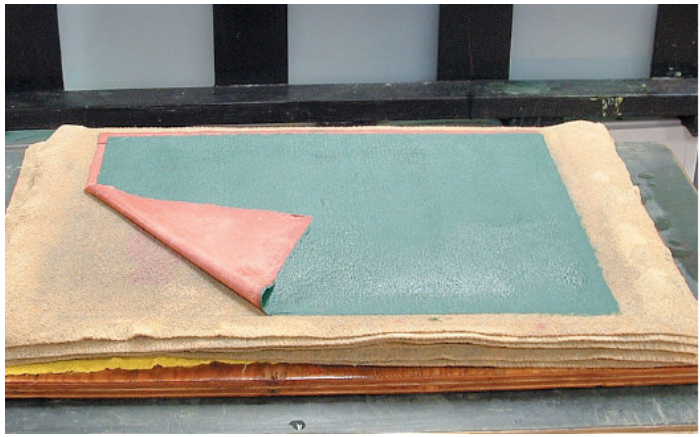
2. We then pull a sheet of the second color and couch it directly onto the first.

In some cases, we apply a layer of methylcellulose to the first sheet before couching the second sheet onto the gel. This is usually not required but may be desirable for many reasons.

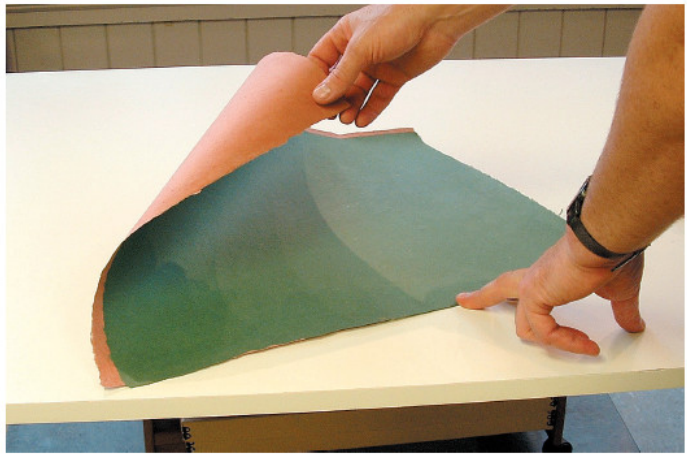
3. Pressing firmly, we transfer the wet pulp from the screen onto the first.



4. The second color shows in the photo after we remove the screen.



5. The doubled layer of wet pulp is stronger, and is then covered with felt, pressed and dried overnight between blotters in a fan box.



6. This sheet of duo paper is now ready to fold.

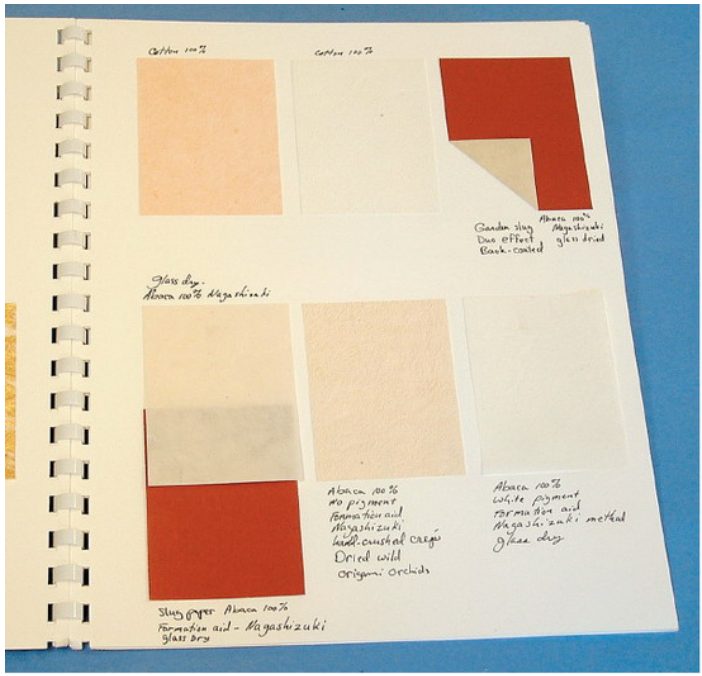
Now that you have an understanding of the papermaking process, experiment with the paper pulp recipes in the next chapter. Though it may take time to create paper that you are happy with, it will be well worth the effort.

PAPER PULP RECIPES

Most advanced origami projects require more strength than typical papers formed of wood pulp. We prefer to make paper with at least half of the fiber from the abaca plant. Some added hemp or flax will make the paper harder; cotton will make it softer. Use the cotton blends for cuddly creatures such as dogs, cats, pigs and other furry critters. Use the harder paper for leathery bats, insects and models that have sharper folds, such as my North American Cardinal.

In this section, we include our recipes for paper pulps that work well for origami projects. Create the pulps described here, and then follow the papermaking instructions in the previous chapter to produce the finished paper. Beat the pulps separately so you can add them to smaller batches for testing. We use a one-pound capacity beater and tend to beat the fibers for at least thirty minutes. Tissue-thin papers require beating the pulps for several hours, and it is not unheard of to beat abaca for six hours. See the recommended beating time for each pulp.

The blended pulps are colored and sheet-formed first in small test batches, and we use either an electric drier or microwave oven to preview the final result. This allows us to adjust the proportions and colors before blending, coloring and suspending an entire batch of fiber in the vat.



Scrapbook of handmade paper samples and notes of fiber blends, coloring agents and beating times.

PAPER FIBERS AND BEATING TIMES

I use many different fiber blends in my work. Each has specific qualities for sheet-forming and final results. You can use these fibers for making your own pulp for your papermaking, or you can use them when ordering ready-to-use pulp.

Abaca (*Musa textilis*)

This is a great all-purpose pulp. It is the strongest of all the plant fibers listed. This somewhat silky and springy pulp is an excellent choice for any origami project. Beating time can be anywhere from a half-hour to twelve hours. Use 100 percent or in blends.

Cotton Rag (Also called "half stuff")

This pulp produces a very strong sheet and with good compressibility. Beating time can be anywhere from a half-hour to four hours. Use 100 percent or in blends.

Cotton Linters

This pulp produces a softer sheet with some "tooth." Beating time can be anywhere from a half-hour to one hour. I use in blends only.

True Hemp (*Canabis sativa*)

This pulp produces a strong, crisp sheet with some tooth. Beating time can be anywhere from a half-hour to eight hours. Use 100 percent or in blends.

Flax (*Linum usitatissimum*)

These sheets are strong and crisp. Excellent for over-beaten pulps and tissue making. Beating time can be anywhere from a half-hour to twelve hours. Use 100 percent or in blends.

THREE GENERAL PURPOSE PULPS

These pulps are very strong and are easy to form into even sheets. I use these pulps to make paper for folding mammal and bird subjects of simple to intermediate complexity. The sheets may be formed moderately thin to very thick. The qualities of these pulps are excellent for wet-folding techniques. The abaca fibers will be long and strong while the cotton adds softness and compressibility.

Abaca, 80 percent, Cotton Linters, first-cut, 20 percent
Beating time: One hour.
Internal size: Liquid alkylketene dimer emulsion (I use 4 tablespoons per dry pound of pulp, which is double the usual dose).

Beat both pulps in the same batch. Add color, if desired, and then add the liquid size. Mix well.

Overbeaten Abaca Pulp, 100 percent
Beating time: Six to twelve hours.
Internal size: None.

Overbeating makes this pulp extremely strong and somewhat translucent. It drains slowly on the screen and can be a challenge to form into large sheets. I use this pulp to make paper for folding animal and plant subjects of intermediate to super-complex levels. The sheets may be formed as thin as tissue. Such papers are perfect for folding origami insect models.

Abaca, 100 percent
Beating time: Four to six hours.
Internal size: Liquid alkylketene dimer emulsion (I use 2 tablespoons per dry pound of pulp).

Beat pulp. Add color, if desired, and then add the liquid size. Mix well.

Satoshi Kamiya's 50/50 Blend
Abaca, 50 percent
True Hemp, 50 percent

Beating time: Three to eight hours.

Internal size: Liquid alkylketene dimer emulsion (I use 2 tablespoons per dry pound of pulp).

I named this pulp for Satoshi Kamiya, who is a brilliant and gifted origami artist from Nagoya, Japan. Satoshi came to the Origamido Studio in 2001–2 to study papermaking for origami. After much preliminary experimenting, he determined that his favorite blend was 50 percent abaca and 50 percent True Hemp, each beaten separately for at least three hours. This pulp is then formed as thin as tissue for Satoshi's super-complex origami insect designs. It has the strength and resilience of the abaca and a nice toothy texture contributed by the hemp.

One can beat both pulps in the same batch. After beating, add color, if desired, and then add the liquid size. Mix well.

Robert Lang's Origami Insect Paper
Abaca, 60 percent
True Hemp, 40 percent

Beating time: Hemp, four hours; abaca, six to eight hours.

Internal size: Liquid alkylketene dimer emulsion (I use 2 tablespoons per dry pound of pulp).

I named this pulp for Dr Robert Lang, who is one of the most important American origami artists. Robert's contributions to origami are numerous and in many different areas. He has come to the Origamido Studio on many occasions to learn about papermaking for origami and to make his own paper. I have been tinkering with blends and methods for Robert's super-complex designs for several years now. His work and the conversations we have had have been a driving force in much of my recent experiments in papermaking. This special blend is one of my favorites.

Beat each pulp separately and then blend them together. Add color, if desired, and then add the liquid size. Mix well.

Cotton Blend
Cotton Linters or Cotton Rag, 70 percent

Abaca, 30 percent

Beating time: Cotton, one hour; abaca, two to four hours.

Internal size: Liquid alkylketene dimer emulsion (I use 2 tablespoons per dry pound of pulp).

This is a wonderful pulp for folding mammal subjects. The cotton provides a nice texture and compressibility, while the abaca provides extra strength and springiness. Use linters for a softer paper and rag for a harder, smoother paper.

Beat each pulp separately and then blend. Add color, if desired, and then add the liquid size. Mix well.

RESOURCES

ORIGAMI ORGANIZATIONS

OrigamiUSA
15 W 77th Street
New York, NY 10024
www.origamiusa.org

BOS—British Origami Society
Penny Groom
2A The Chestnuts
Coountesthorpe
Leicester LE8 5TL
ENGLAND
www.britishorigami.info

Mouvement Francais des
Plieurs de Papier
56, Rue Coriolis, 75012
Paris, FRANCE
www.mfpp-origami.fr

Centro Diffusione Origami
PO Box 28
27011 Belgioioso (PV)
ITALY
www.origami-cdo.it

JOAS—Japan Origami Academic Society
Gallery Origami House
1–33–8–216 Hakusan
Bunkyo–ku, Tokyo
113–0001 JAPAN
www.origami.gr.jp

NOA—Nippon Origami Association
2–064, Domir–Gobancho
12 Gobancho
Chiyoda–ku, Tokyo
102–0076 JAPAN
www.origami-noa.jp

Asociacion Espanola de Papiroflexia
Apartado de Correos 13156
28080 Madrid
SPAIN
www.pajarita.org

PAPERMAKING RESOURCES

Carriage House Paper
79 Guernsey Street
Brooklyn, NY 11222
Phone: (718) 599-PULP and (800) 669-8781
www.carriagehousepaper.com

The Research Institute of Paper History
Carriage House
8 Evans Road
Brookline, MA 02146–2116
Phone: (617) 232-1636
www.papermakinghistory.org

Twinrocker
PO Box 413
Brookston, IN 47923
Phone: (765) 563-3119 and (800) 757-8946
www.twinrocker.com

Dieu Donne Papermill, Inc.
433 Broome Street
New York, NY 10013
Phone: (212) 226-0573
www.dieudonne.org

Magnolia Editions
2527 Magnolia Street
Oakland, CA 94607
Phone: (510) 839-5268
www.magnoliaeditions.com

ABOUT THE AUTHORS

Michael G. LaFosse is best known as a paperfolding artist, one of the few who also makes his own handmade papers. He has enjoyed the art of origami since 1962, and has been teaching paperfolding and papermaking since 1972. LaFosse's most popular works in handmade paper are of natural history subjects; in college, he studied biology as well as math and art. His work is shown in national and international museums and galleries, including the Peabody Essex Museum, Salem, Massachusetts; the Arizona-Sonora Desert Museum, Tucson, Arizona; and the Carousel du Louvre, Paris. He has toured five major cities in Japan with Master Akira Yoshizawa's life retrospective origami exhibit.

Michael created a spectacular show of original origami natural history sculptures after an internship at the Arizona-Sonora Desert Museum in Tucson. Over 40,000 people viewed his works on display at their Ironwoods Gallery. In 2004, he studied plants and animals of the Florida Everglades in preparation for the 2005 exhibit "FLorigami" at the Morikami Japanese Museum and Gardens, Del Ray Beach, Florida. Some of the more unusual origami applications that have employed LaFosse's talent include elaborately folded pastry and hors d'oeuvres, and custom-folded plastic components for clean rooms and earth orbiting satellites.

Richard L. Alexander was raised on a dairy farm in the rolling, forested hills near Ithaca, New York. Cornell University was an oasis, an exciting blend of engineers and artists, where both disciplines engaged in a healthy dialogue of review and critique. He put his Cornell Systems Ecology degree to work, consulting in factories to reduce waste and pollution while also improving lives and profits. He kept his hand in art and engineering by building an experimental airplane and designing his own passive solar home on the banks of the Merrimack River. Soon after, he met LaFosse and was intrigued by how his advanced origami beautifully blended art and engineering. They began helping each other with their respective careers. Richard's background of developing and presenting training programs in industry involved extensive writing, photography and video production, and he brought these to their partnership.

The authors co-founded the Origamido Studio in 1996, a commercial design studio, origami classroom, hand papermaking facility and gallery displaying exquisite origami and paper arts from over 60 artists. Alexander has been the principal hand papermaker and workshop instructor at the studio since 2002. Together, LaFosse and Alexander have created dozens of origami exhibitions and over 70 books, kits and videos about paper and paper arts. They consult to engineers, teachers and artists, and design props for TV, print, web-based and tangible advertising.

ACKNOWLEDGMENTS

I must first thank my parents and grandparents, especially my grandmother, who instilled in me when I was quite young the valuable realization that I could sit down and make incredible things out of paper, using only my hands. It is true that for years I worked in relative isolation. My work was admired and encouraged by Lillian Oppenheimer, Alice Gray and a few of their friends at the Origami Center of America, but by and large the origami community in the 1970s did not recognize my work as paperfolding. Likewise, the fiber artists and paper sculptors did not embrace my origami as paper art. I owe my breakthrough to Akira Yoshizawa, whose self-portrait in origami was juxtaposed with his photo in an article published in *Reader's Digest*. This presentation both validated my efforts and challenged me to create even more wonderful wet-folded origami creations. Inspired by Yoshizawa's works, I began to make my own paper, but I must also thank Elaine Koretsky of Carriage House Paper in Brookline, Massachusetts. Elaine, her husband Sidney and their daughter Donna Reina, have paved the way for today's hand papermakers desiring archivally colored art materials.

Despite my isolation in the early years there were, however, a handful of ardent supporters, including Dr Robert Rossi, his wife Van

and their children Paul, Anne and Greg, who encouraged my paperfolding efforts and faithfully cheered me on as a real artist. I am deeply grateful for the art education that resulted in the thousands of hours of great times and conversations I shared with them at the Rossi homestead and in the summertime at their rustic camp on Vinton Pond in West Townsend, Massachusetts. The wildlife at this pristine pond has been the most important source of inspiration for many of my fondest origami creations.

My special thanks go to Jennifer Brown, Acquisitions Editor at Tuttle Publishing. It has been a great pleasure to work with her not only on this book but on many other origami publishing projects during the last several years. Jennifer's ability to grasp the important aspects of presenting origami design has made her a great ally. I am thankful to the entire team at Tuttle for supporting us in these efforts.

Finally, I must thank my partner Richard Alexander, who not only recognized how special my origami work was but made it possible for me to focus on art as my vocation. Richard was the first to produce professional displays of my work. He showed me how to transform my crumpled pieces of paper, which I kept in a cigar box, into exquisite well-lit masterworks that hold their own in any art gallery or museum—indeed even the Louvre! Richard critiqued, composed, framed and put my art under dust bonnets. He took excellent promo photos, and has documented the past decades of my work. His focus was not just my art. He also put me in a jacket and tie for nearly every public appearance and made me comfortable in front of TV and video cameras. He helped me improve my writing skills and provided the computer tools to help me author numerous books. Above all, he provided me with the Origamido Studio, a place where we could design great new creations—a place where I could live my dream. It has been hard work but it has been so much easier since we have done it together, and you are holding just one remarkable result in your hands.

We dedicate this revised and video-enhanced edition to our parents, Betty and Jerry LaFosse and Lee and Irene Alexander. Early on, they recognized the unique contributions to origami art that our partnership and the Origamido Studio have produced. They took particular pride in watching our public exhibitions develop as our list of original designs, publications and international recognition grew.

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Photography by Richard Alexander includes: Praying Mantis, North American Cardinal, Toco Toucan, Goldfish, Big Brown Bat, Origamido Butterfly, Sea Turtle, Wilbur (the Piglet), Ruby-Throated Hummingbird, Cattleya Orchid, various papermaking and back-coating scenes from Origamido Studio.

Photography by Michael Lafferty includes: Squirrel, Panther Mask, Horseshoe Crab, Koi, Frog, Happy Good-Luck Bat, *Strombus gallus* (front and back views).

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